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THE

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REDUCTION OF POSTAGE TO INDIA, &c.—On and after the 1st of January, 1891, the postage to be prepaid on letters passing between this country and India, and also between this country and the undermentioned colonies, will be 2½d. the half ounce:—The Australasian Colonies, viz.: New South Wales, Victoria, South Australia, Queensland, Western Australia, Tasmania, New Zealand, Fiji, British New Guinea. Mauritius and its dependencies, viz., The Seychelles, Diego Garcia (Chagos Islands), &c. Hong Kong, Ceylon, Straits Settlements, British North Borneo, Labuan, Sarawak Cape Colony, Natal, St. Helena, Ascension, Sierra Leone, Lagos, Gold Coast, and Gambia. The British West Indies, viz.: Barbados Trinidad, Tobago, Jamaica, Turks Island, British Guiana, Antigua, Dominica, Grenada, Nevis, Montserrat, St. Kitt's, St. Lucia, St. Vincent, and their several dependencies. Falkland Islands and British Honduras. The reduced postage will be applicable to all routes, except in the case of the Cape and Natal. The rate for post-cards to Australasia, New Zealand, Fiji, and British New Guinea, by any route, will be 2d. In regard to the rest of the colonies named, and to India, there will be no change in the postcard rate; and no alteration will take place in the postage to be prepaid upon newspapers, books, and patterns. Unpaid and insufficiently paid correspondence of all classes passing between this country and all the places named will be treated as that to and from some of them already is—that is to say, it will be charged on delivery with double the deficiency instead of the deficiency and a fine.

The following, respecting the importation of American granulated sugar into England, is taken from the *Telegraphische Correspondenz*:—

We hear from Liverpool that dealers have been rendered cautious in their operations in consequence of fine American granulated having been offered at 16s. 6d. cif. in the English market. In connection with this it may be observed that from the 1st January to the 4th December 20,846 tons (against only 249 tons in the preceding year) of refined were imported from the United States, and that a considerably increased export may be looked for from thence in future as a consequence of the present arrangement of the American customs duties. It is well known that this export consists principally of granulated, and goes to England, and also that the American granulated is very much liked in England. It seems right to call attention to this re-awakening competition on the part of the United States in the English markets just at the present moment, and to lay stress on the fact that the legal protection enjoyed by the North American refiners puts them in a position to be able to take raw sugars from us, and after refining them to put them on the English market in competition with our refined article. This is one of the facts that cast a strong light on the projected German legislation, and show plainly how little adapted it is to deal with the state of things with which we have to contend in foreign countries. It is true that in the preamble of the new law there is a sort of regret expressed that our industry should have developed into an export trade, and it is only a natural outcome of such views that a reform in fiscal legislation should be proposed, which will make us incapable of exporting, and open the way for foreigners to markets which we have hitherto commanded in a manner exceedingly welcome to them.

The Honourable G. E. Foster is now making a tour through the West Indies in the interests of the Dominion of Canada to establish reciprocal commercial and tariff relations between the latter country and the islands. He states that Canada is prepared to receive all the sugar which the English West Indies now send to the United States, and expresses the belief that no obstacle would be put in the way by the British Government. We must all wish well to any and every effort to draw closer the bonds of interests between the British colonies, but no one can ignore the initial difficulties which the question presents.

A successful Exhibition was opened in Trinidad on the 27th October, and sugar was well represented. The *Port of Spain Gazette* has the following remarks, which have a cheerful and confident ring that is very pleasant to hear :—

"In looking over these white and coloured crystals of high polarization, and the improvements in muscovado and molasses sugar, the thought that this great progress was only of recent growth and only a resting stage in the continued progress of cane sugar manufacture, while beet must remain stationary, opened a vista beyond the immediate horizon that gave a glimpse of what is likely to be and in fact, is already being predicted—namely, the discovery of the process that will produce on the estate itself the refined sugar of commerce. The final stage is being approached every day, and new processes all show this conscious or unconscious tendency of the nature of things."

It is interesting, in connection with the Jamaica Exhibition, to learn that Mr. D. Morris, of the Kew Botanic Gardens, has gone out to assist in the exhibition and also in developing the agricultural industry, principally in connection with tanning substances.

The Demerara *Daily Chronicle* of December 3rd contains the full text of the proposed Electric Lighting Bill. The old country must make haste unless she means to be outstripped in this most desirable path of progress.

The Louisiana sugar crop—which is now being got into the market as quickly as possible, in view of the forthcoming change in the sugar duties and their effect beforehand on prices—is said to be the largest since the civil war.

We learn from the *Louisiana Planter* that Messrs. E. H. Dyer and Co., of Alvarado, Cal., are now building near Salt Lake City, Utah, a 350 ton daily capacity beet sugar factory. The factory is owned principally by capitalists of Salt Lake City, and the machinery is all American, being built by the Kilby Manufacturing Company, of Cleveland, Ohio.

The *Havana Weekly Report* says :—It is now beyond a doubt that the coming crop will be a very heavy one, possibly the largest ever produced on the island, excepting, perhaps, that of 1873, the outset of which was over 800,000 tons.

The acreage has been largely increased for this year's crop; the season is now too far advanced to entertain any fears of destructive cyclones; the fields, with very rare exceptions, here and there, never before looked better, so unless an unnatural and most extraordinarily

early rainy season sets in, which will prevent the working of the last third of the crop, we see nothing that can eventually cause us to repent of our prognostications.

The eleven largest estates in the Cienfuegos district are expected to produce 145,000 hogsheads. Of these the Central Constancia will supply 30,000, and the Central Caracas 20,000. The latter is the only one of the eleven which works with diffusion, as well as crushing. There is an opinion prevalent in Cuba that President Harrison will not, in any case, venture to restore the old sugar duties, as he is authorised to do by the reciprocity clause, because his term of office is drawing to a close.

We would call attention to an article on the Indian Sugar Industry, which will be found in this number. The *Indian Agriculturist* has the following remarks on this subject:—"The peasantry as a rule are so extremely poor that it is quite out of their power, even if they had the necessary knowledge, to provide the ways and means for the improvement of their traditional industry. The State in India is to a great extent the absolute lord of the soil; and the land is the mainstay of its revenues. It is therefore under a double obligation, both for the sake of its subjects and in its own financial interests, to do whatever lies in its power to develop and improve an industry on which the welfare of the Government and its subjects so largely depends. We have had for about two decades out of more than a century and a half of our rule a Department of Agriculture which has done very much less for agriculture than agriculture has done for itself, and we do not look forward with much hope to what it may do in the immediate future."

We are able at last to give a tolerably complete table of the results of the working of German sugar factories in 1888-89. Want of space compels us to omit any further details this month of results of the 1889-90 campaign.

The proposed new sugar legislation in Germany continues to cause great excitement, and petitions and remonstrances have been sent in to the Reichstag from all the various unions of manufacturers and agriculturists, including the workmen employed in the factories. It scarcely seems probable that there will be any great alteration recommended by the Commission to which the matter has been relegated. On the other hand, the French Ministry have so far given way to the pressure of the fabricants as to introduce a measure providing that for the financial year 1891 manufacturers renouncing the bounty on the excédants over the estimated yield shall be granted a reduction of duty on 20% of the amount of sugar they have made, the duty to be 30fr. in place of 60fr. per 100 kilos. After September, 1891, the legal yield to be 7·750%.

1890.

The year which has just closed presents, in contra-distinction to the one which preceded, a complete absence of any such excited movements in the market as that which so remarkably characterised the middle of 1889. After a storm comes a calm, and although circumstances themselves have not been favourable to any financial speculations or combinations that could exercise a disturbing influence on prices, yet there can be no doubt that one great cause of this want of excitement or even special animation must be looked for in the caution and reserve shown, in a very marked degree, in buying operations. Prices of German-Austrian, West India, and Java sugars close somewhat higher than the figures at which they left off in 1889, and the market may be considered as in a fairly healthy condition.

The depletion of stocks has in some instances been carried to an extent which might be thought excessive, but in face of the sufficiently abundant supplies available during a great part of the year, the cautious action on the part of buyers seems to have been fully justified. It is probably mainly owing to this caution and abstention that in spite of the scarcity of cane for immediate delivery in August and September no sensible advance was established.

The stocks in Europe at the end of November were 137,000 tons lower than at the same time in 1889. The increase in consumption in Europe for the twelve months ending 30th November, 1890, amounts to 240,000 tons, and in the United States to 51,000 tons, over that of the preceding twelve months. This increased consumption in Europe has, however, shown distinct signs of falling off during the last two months.

The reappearance of American granulated sugars on the English market is one of the noteworthy events of the year, and is alluded to with some feeling of alarm by the *Telegraphische Correspondenz* in a short article, a translation of which will be found on another page. In October last Messrs. Willett & Gray remarked :—"A rather interesting problem, which cannot be solved without trial, is whether our refiners can continue or enlarge the exportation of refined sugar to England and elsewhere."

That the position of the British refiners, already rendered exceedingly difficult by the competition of France and Germany, is made still more unenviable by the renewal of the imports from America, is self-evident.

Imports of refined of all sorts from France, Germany and the States, show a steady and large increase for the past two years. From Russia we have, during the past 12 months, had only about 300 tons, against over 30,000 tons last year, but this is only a small item in a total import amounting to nearly 500,000 tons. On the other hand, the exports have remained almost stationary. The imports of raw sugar have fallen below those of last year, the marked increase in those from France and Germany being more than counterbalanced by the falling off in the quantities coming from India, Java, Brazil, the Philippines, and the West Indies, these countries being arranged in the relative order of their respective decrease. The falling off in the East Indian imports is about 60 per cent., and in those from Java about 40 per cent. Some of our Colonies are increasing their direct exports to Continental countries. For example: in 1889, 16,500 tons were imported into Genoa from English Colonies, against only 3,110 tons in 1888.

The following are the average prices for German and Austrian 88% beet, West India, and Java sugars during the past seven years:—

GERMAN-AUSTRIAN BEET, 88°/₀.

	1884.	1885.	1886.	1887.	1888.	1889.	1890.
First Quarter	17/1	11/5	13/7½	10/10	14/9	13/11½	11/11
Second ,,	14/7¾	14/6	12/1½	11/8½	13/5	20/4	12/3
Third ,,	13/6	15/2	11/1½	12/7	14/3	21/5	13/1
Fourth ,,	10/6½	14/9½	10/9	13/7	13/3	12/1	12/9
Year's Average	13/11	13/11½	11/10½	12/2	13/11	16/11½	12/6

WEST INDIA.

	1884.	1885.	1886.	1887.	1888.	1889.	1890.
First Quarter	16/7	11/4	13/6	10/8	13/6	13/3	11/8
Second ,,	14/-	14/10	12/3	11/-	13/-	17/6	11/11
Third ,,	11/4	14/10	11/4	12/-	13/-	20/-	12/3
Fourth ,,	11/2	14/11	11/3	13/7	13/4	13/2	12/6
Year's Average	13/3¼	13/11¾	12/1	11/9¾	13/2½	16/-	12/1

JAVA.

	1884.	1885.	1886.	1887.	1888.	1889.	1890.
First Quarter	20/8	14/7	15/4	13/2	16/1	16/9	14/11½
Second ,,	18/3	17/6	14/3	13/7	15/7	21/9	14/10
Third ,,	15/8	17/1	13/3	13/10	13/10	22/7	15/3½
Fourth ,,	14/8	17/7	13/5	15/9	15/9	15/3	15/4
Year's Average	17/3¼	16/8¼	14/0¾	14/1	16/1¼	19/1	15/1

Though the year, as regards movement in prices, has been devoid of any special feature of interest, this cannot by any means be said with respect to legislation on sugar matters in foreign countries. The

definite abandonment of any further attempt to bring about united action with regard to the bounties seemed for the moment to have closed the door to any hope of improvement in this direction, but it is now apparent that the persistent efforts of our Government, so ably seconded by all the leading men in the refining trade in this country, have not altogether failed. The German Government in particular has been so deeply impressed with the ultimate mischievous effect of the system as to propose, at what seems to many a rather inopportune moment, a re-arrangement of the duties on sugar, which will in a short time bring about the total abolition of bounties on export. And if we may judge by all that has hitherto transpired, they intend to carry out their proposals; for although the consideration of portions of the scheme has been confided to a Commission of the Reichstag, yet the constitution of that commission scarcely authorises the expectation that its members will recommend any considerable change in the original project. And it may be fairly assumed that the French Government also has had its eyes opened to the extent to which the sugar industry was preying on the State revenues by the repeated arguments of the bounty abolitionists. It is true the French ministers have, for the moment, given way partially to the insistance of the sugar manufacturers, seconded fortunately for them by a less favourable season than the past very exceptional one of 1889-90, but the proposals for alteration now under debate indicate the firm intention to abide by the course originally adopted. That they should at once follow the example of Germany is not to be expected, but, as we have before remarked, they have a very true proverb, "Nothing is impossible in a Republic," and we may live to see stranger things even than the abandoment of the bounties by France.

Finally, the new McKinley tariff of the United States has introduced an element of doubt and confusion into all those calculations in sugar matters which had hitherto been regarded as tolerably stable. The question of the effect of the new regulations is still so much *sub judice* that we shall refrain from the endeavour to discuss it, more especially as the sugar clause does not come into operation until next April.

We may refer to an article on the position of the market, by the able statistician of the *Prager Zuckermarkt*, a translation of which is printed in our present issue, merely remarking that it will be observed that the figures for the world's production differ from those of Mr.

Licht, partly owing to the fact that the two statisticians adopt different periods for their estimates of the cane crop, but mainly to the much lower estimates of the beet crop adopted by Mr. Horinek for all countries.

A perusal of the articles and letters which have appeared in our columns during the past year (see also this present number) will have convinced almost any reader that the great question of mill-crushing *v.* diffusion is as yet unsettled, the only thing that appears to be certain is that the old-fashioned mill-work cannot equal diffusion, but this by no means presupposes that the same can be said or even predicted of the improved double crushing.

The American Sugar Trust is passing through a crisis, and certificates have declined smartly, but it would be rash to predict the turn which events will ultimately take.

THE POSITION OF THE MARKET.

From the *Prager Zuckermarkt.*

According to the statements published from time to time in this journal the deliveries of sugar for the world's consumption for the last ten years have been as follows:—

		As compared with preceding year.	
Year.	Tons.	Increase.	Decrease.
1880-81	3,630,000	......	......
1881-82	4,020,000	390,000	......
1882-83	4,260,000	240,000	......
1883-84	4,150,000	......	110,000
1884-85	4,750,000	600,000	......
1885-86	4,620,000	......	130,000
1886-87	5,200,000	580,000	......
1887-88	5,130,000	......	70,000
1888-89	4,980,000	.....	150,000
1889-90	5,750,000	770,000	......

Total .... 46,490,000, or an annual average of 4,649,000 tons.

In looking at these figures we are at once struck by the fact that the differences from year to year alternate pretty regularly between increase and decrease. The two first campaigns form an exception, both showing an increase, and again the two last but one, both showing a decrease. According to our view the reason of the first

phenomenon, viz., the regular yearly alternation of increase and decrease, is to be found in this, that in the campaign in which there has been an increase of consumption, a repletion of the invisible stocks has taken place concurrently with an increase of the actual consumption, in consequence of which the next following campaign closes with a diminution of deliveries, because the actual consumption (which it must be remembered is constantly increasing) has been able from the invisible stocks to supply such a portion of its needs as thereby to cause an increase in the amount of the visible stocks, the result being an apparent falling off in the consumption.

That under certain circumstances this regularity of movement may undergo an interruption is shown by the two last but one campaigns; that of 1888-9 ought to have closed with an excess in the deliveries over the preceding campaign, but, in consequence of the high prices prevailing in 1889, there was such an abstention on the part of consumers from withdrawal out of the visible stocks that the final result was a decrease in the deliveries. This result appears to us to have been only possible because of the campaign of 1887-88 having closed with but a small minus of 70,000 tons, so that the consumption was able to draw from its own stocks in the campaign of 1888-89 also. Along with this fact we must take the early arrival of deliveries from Java and the early commencement of the beet sugar campaign, so that the scarcity of sugar with which the world's market was actually threatened was thereby removed. That this last remark with regard to the narrow escape from a sugar famine is no way overdrawn, is shown by the state of things at the beginning of the campaign of 1889-90, when in Bohemia (for example) there was no sugar to be had in whole districts, and the quantities taxed for passing into consumption reached—in Austria, in November 344,873 quintals, in December 283,594 quintals, in January 293,049 quintals, in February 284,801 quintals; in Germany, in October 486,720 quintals, in November 609,820 quintals, in December 475,650 quintals; in France, in October 556,400 quintals, in November 583,178 quintals, in December 551,320 quintals—a proof how bare of sugar these very countries which produce and export sugar had become. This is still further shown by the colossal excess of the world's deliveries for 1889-90, which only appears explicable by the assumption that the invisible stocks of consumers had been drawn upon almost to exhaustion.

After this retrospect into the past we may now attempt to take a glance into the proximate future.

The principal question is—What will be the quantities passing into the world's consumption in the campaign of 1890-91?

Of course, any assumptions on this point can only lay claim to a sort of approximative probability, as the course which may be adopted by consumers cannot be fixed beforehand by anyone. The first question is the extent which will probably be attained by the actual consumption, and further, whether consumers under certain circumstances would be in a position to draw supplies from their own stocks. As regards the first point we will endeavour to arrive at some idea. According to the table above given, the annual deliveries in the ten last campaigns amounted on an average to 4,649,000 tons. This average cannot, however, be assumed without correction as the actual consumption of the year (1885) standing at middle of the ten years' period. Further, we are justified in venturing to assume that the actual consumption is subject to a steady and continuous increase, tolerably regular as regards amount.

With these two presuppositions we shall be in a position to draw up a table of the actual consumption for the past ten years as follows:—

		Tons.
1880-81		3,630,000
	Increase	225,000
1881-82		3,855,000
	Increase	225,000
1882-83		4,080,000
	Increase	225,000
1883-84		4,305,000
	Increase	225,000
1884-85		4,530,000
For the year 1885	**4,649,000**	
	Increase	225,000
1885-86		4,755,000
	Increase	225,000
1886-87		4,980,000
	Increase	225,000
1887-88		5,205,000
	Increase	225,000
1888-89		5,430,000
	Increase	225,000
1889-90		5,655,000
	Total	46,425,000
	Deliveries (according to first table)	46,490,000

Now, if we again assume for the current campaign an increase of the *actual consumption* of 225,000 tons we arrive at a consumption of 5,580,000 tons. Against this we have a production estimated in our statistical tables at 5,886,000 tons, and from this we may deduce that on the whole the statistical position of the article will not undergo any great alteration in the course of the present campaign, that is, that the stocks at the end of 1890-91 will be very nearly the same as at the end of 1889-90. According to this we should not have to look for any great movement in the prices of sugar either upward or downward.

But the principal question is not how great will the actual consumption be, but what will be the amount of the sugar delivered out for consumption. These deliveries may either be equal to, or greater, or less than the actual consumption. According to the tolerably regular increase and decrease of these deliveries, we ought really to expect that the great increase of the previous campaign would be followed by a decrease in the present. But assuming that, after the two decreases (following each other) in deliveries in the preceding two campaigns, the increase of the last campaign, besides covering the actual consumption, only sufficed to fill up the so-called "iron" stocks; then, in view of the circumstance that the world's production this season at present promises to be in round numbers 280,000 tons greater than its predecessor, and also assuming that in the present case we shall again have an increase in the deliveries (that is to say two increases, one immediately following the other) then it is not until these 280,000 tons have been exceeded by the increase of deliveries that any improvement of the statistical position of the world's market, in comparison with the campaign just closed, can take place. Whether such an increase or even a greater increase can be looked for is a question that we must leave untouched. People are expecting wonders in this respect from the reduction of the import duties into the United States. If these expectations are fulfilled, everything may after all turn out well, but in the contrary case things will be all the worse. And especially will this be so, *if the amount of beets cultivated next season should again be greater.*

If the cultivation is pushed to excess, and the beets turn out well, we may easily see another year like 1884.

On the other hand, the position at present is such that, *with a due restriction of the cultivation of beets*, the sugar industry all over Europe

may look forward to future developments, with the prospect of again posing as the decisive factor in the regulation of prices. And that in such case the agriculturists would be much better off, we need not attempt to show in detail, for good prices for beets are only possible when good prices can be obtained for sugar.

In their own interest (properly understood) the watchword, not alone for the manufacturing, but also especially for the agricultural industry, must then be:—Liberal restriction of the beet cultivation for the coming campaign!

THE FUTURE INTRINSIC VALUE OF SUGAR ESTATES.

By Mr. J. Mann Cage.

In that the impetus given cane sugar production during the early part of the century, was due to the existence of the institution of slavery, and the major portion of the commercial sugars of the world, were produced by servile labour, it was but the natural sequence that the value of the estates was based on the number of slaves in possession of the proprietors, and the fertility of the soils viewed as a secondary consideration, except in the estimation of experts. Having no rivals in the industry the revenues which accrued to many were princely in amount, and expenditures lavish. Generally, cultivation and manufacture were somewhat primitive in character, yet at a later date large sums were expended in costly buildings and apparatus, the object being to arrive at an increased daily crushing and evaporating capacity, at a sacrifice of the quality of the work performed, the result of which was an immense waste of raw material in fabrication.

After the emancipation of the slaves, the cost and size of the establishments were considered prime factors in valuations, but now the magnitude of the output of beet sugars has so cheapened the product that estimates have been materially revolutionized, when taken in conjunction with the results which have been attained with cane by diffusion and compound diffusion—each aided by superior technical control.

Had the cane sugar producers been in the van in scientific research, in fabrication, fertilizing and cultivation, instead of their rivals in the beet sugar industry at a later date in Europe, sugar production from beets would have been seriously retarded, and perhaps never developed to its present proportions.

In the race of industrial progress many of the cane sugar producers found themselves heavily handicapped by past lethargy, and some almost insurmountable hindrances, and it will take some years of watchful perseverance and indomitable energy to retrieve the lost ground in the supply of the world's requirements, and victory must be won by learning to make cheap sugars from a plant by nature infinitely superior to the beet.

Five years ago a plantation with an apparatus which gave an output of 7½% (150 lbs.) of sugar was viewed as having a superior plant, but to-day engineers may demand 10% (200 lbs.) and upwards from good anes. In future the value of a sugar house (regardless of the lands of the estate) as a profitable investment will depend upon the plant as an effective and eminently economical means of separating the sugar from the cane fibre (leaving the latter in the best possible condition for fuel) at the least cost of labour, etc., and where capital is invested in expensive buildings it will be viewed as a somewhat useless expenditure of money where it exceeds the necessary outlay to secure convenience and protection to the apparatus from the damaging influence of the elements. As sugar manufacture is in a transition state, the efficient apparatus of to-day may in a short space of time be rendered comparatively valueless by new discoveries; therefore the surroundings should be such as to render alterations as inexpensive as possible.

To-day diffusion and multiple effect evaporation are regarded by many as the future method of juice extraction and concentration to masse cuite; yet may they not be superseded in a short term of years by forces and elements perhaps at present unknown to science as applied to the arts and manufacture?

Capitalists desirous of investing in sugar producing property, on inspecting an estate, will desire to inform themselves of the quantitative capacity of the apparatus, not only as to the pounds of sugar to be had per ton of cane (according to the sugar content), but the number of tons which can be manipulated per day. A milling plant (single or double), where the strength limits the extraction to 60 or 72%, and where the generating and evaporating surfaces are such as to necessitate a heavy outlay of fuel, and where the output ranges from 125 to 145lbs. of sugar per ton of cane, with 12½% (and over) sucrose therein, will be considered of relatively little value, as much of the machinery or the entire plant will have to be replaced at great

expense to insure superior results, which may prove almost absolutely imperative to guard against ultimate loss. A plant is neither desirable or economical which is not approximately effective in all its parts, and it matters not whether the extraction is accomplished by diffusion or otherwise, as it is an established fact that some mills produce better financial results than are had in some houses where diffusion is employed. The future financial success of sugar estates may depend as much on the accurate information displayed in the varied manipulations at the factory, as on the perfection of the plant or the quantity and quality of the canes produced. A diffusion plant may be admirable in construction, and the juice extracted brought to a high point of perfection, with the minimum of dilution, yet defective manipulations to masse cuite may seriously affect the amount of sugar per ton of cane. A type of apparatus may be of excellent design and workmanship, and constructed on correct principles, yet fail to produce desirable results, owing to defective technical knowledge on the part of those in charge. The assurance of the prompt annual delivery of canes relatively rich in sucrose, with a high purity coefficient, in such quantities as will keep the apparatus in constant operation during the campaign, will tend greatly to enhance the value of the plant.

Improved agriculture must precede improved machinery, for without an abundance of canes rich in sucrose there can not under ordinary circumstances be favourable financial results accrue, either to the producers of the canes or the proprietors of factories. It is not essential to success that the growers of cane be versed in the mysteries of agricultural chemistry, yet those who direct the operation of fertilizing the fields should inform themselves of the elements which manures should contain to increase the tonnage per acre without decreasing the saccharine content to any marked degree in the canes. The increased yield of sugar per acre in Louisiana has been brought about as much by the system of rotation adopted by the most progressive planters as by improved methods in manufacture. The growing of only two crops of cane (plant at first rattoons), and rotating with a crop of corn or maize, and the invaluable Carolina cow pea, and ploughing them (with the corn stalks) under in the autumn, has done more to recuperate the estates than ought else.

It has proved very injurious to present production in some countries that the cane has the property of annual reproduction for many years without the cost of replanting. The evil of excessive exhaustion by

growing successive crops of rattoons must be first remedied before any marked increase in prosperity can be looked for in many of the sugar producing regions. Nature will assert itself, and refuse to respond to extortionate demands. The exhausted soil of the tropics produce, say, twelve tons of cane per acre, yet what could they be made to yield were they carefully cultivated, rotated judiciously, and fertilized on scientific principles?

We have every reason to believe that many such could be made to yield from twenty-five to fifty tons per acre, and from five to 8000 pounds of sugar and upward. The gradual reduction in the price of sugar has impoverished many owners, and as a result the productiveness of the soils has decreased, and with it their intrinsic value. Instead of supinely awaiting the advent of costly factories with the most improved type of evaporating, generating and extracting apparatus, each proprietor or occupant of the soil can vastly increase the acreage output by having recourse to a superior system of tillage, etc.

Methods of recuperation must vary according to locality and climatic influences; but the cheapest and most effective should be sought and rigidly adhered to. Capital seeking investment will be drawn to such regions as promise abundant raw material on or near which to erect factories, it being important to reduce the cost of transportation to a minimum.

It is therefore incumbent on owners and tenants to so recuperate and cultivate the land (even if areas are curtailed) as to augment yields, and demonstrate the capabilities of their soils (as to tonnage capacity), as thereon will depend much of their future intrinsic value. Until factories are erected, in which very excellent results can be had, and canes paid for according to polarization, it may not pay to invest very largely in the high priced chemicals, rich in immediately available plant food; but it may prove more remunerative for the time being to obtain the expensive nitrogen, by growing some plant of the leguminous family, which derives it from a source other than the surface soil in which cane roots generally seek the major portion of their nourishment.

Does the tropical cane possess within itself qualities such as to justify its cultivators in indulging in the hope that they may ultimately successfully compete with the growers of beets and thereby enhance the future value of the estates?

The growers of beets can only produce a crop of roots every four years, and the soil must be specially fertilized with known ingredients to render their culture usually remunerative. The cane is a much hardier plant, does not require excessive care and garden culture as does the beet, withstands the vicissitudes of climate in a greater degree, and can be made to yield nearly 100% more sugar per acre, if fertilized and cultivated with equal assiduity. The fabrication of cane sugar is less intricate than that of beets; therefore, the cost of manufacture should be less, and the area of transportation not so extended in many localities. Nature supplies the vegetable albumen, so essential to thorough defecation and clarification, whereby most excellent first sugars can be made (to satisfy the fastidious tastes of consumers) without the use of bone-black, and the molasses an excellent food stuff. The bagasse can be utilized to supply an abundance of fuel to perform all the operations of manufacture, if correctly manipulated.

For a term of eight years an acre of land can produce two crops of beets (others intervening), with an output of, say 4,000lbs. of sugar each year, aggregating 8,000lbs. in that time. In that space of time, even in Louisiana, an acre of land can be made to produce 21,600lbs. of sugar with an average yield of 3,600lbs. per acre when in cane. The first two years plant and rattoons, the third year cane. The fourth and fifth years in cane, and the sixth in corn, and the last two years a repetition in cane.

To have indelibly impressed on the mind, that to cultivate partially starved plants is to impoverish the tiller of the soil, will be to recognize the necessity of studying their food requirements and carefully supply them, as thereby alone can maximum yields be reasonably anticipated.

An abundance of immediately available mineral food and an adequate quantity of nitrogen is not alone essential, as plant roots must have air and moisture to enable them to select such as will best promote rapid and healthy growth. An excess of moisture, or a deficiency, will stunt the plant; therefore the necessity of judicious culture to promote capillary action to obviate the latter in great measure, and thorough drainage to free the soil of the former. To enhance the chances of success in cane culture is to become conversant with the climate and other hindrances to healthy vegetation in each locality and to strive to counteract the effects of unfavourable seasons in a manner such that average crops can be grown under such adverse

circumstances. Aid nature lavishly and she will generously reciprocate the treatment by producing abundantly.

It is to be hoped that by disseminating useful information among cane growers, thereby showing the great future possibilities of the industry, many may be aroused from the apathy superinduced by the discouraging decrease in values, and have new life and energy instilled by which cheap sugars can be made and sold at a profit by the producers. The combined action of capitalists and planters may yet place cane sugar production on a parity with beet sugar fabricants, who are now producing the product under more auspicious industrial and financial circumstances, and when that time arrives the intrinsic value of sugar estates will have been greatly enhanced. Then, with intelligent cultivation in the field, advanced technical knowledge in the factories, to control improved methods and apparatus, sugar may be made in such quantity and at such cost as to render the soils on which they are produced approximate in value to those where beets are grown under such favourable auspices in the older European countries.—(*Louisiana Planter.*)

HONOLULU.

ANNUAL MEETING OF THE PLANTERS, HELD OCTOBER 6TH TO 10TH.

Report of the Committees on Manufacture of Sugar and Machinery.

The committees appointed to draw up reports of the year's progress in methods of manufacture of sugar and the machinery employed therein finding that their work lies in parallel lines, have decided to embody what has to be done in one paper, thus avoiding unnecessary repetition, and making a more complete and succinct statement.

As the processes of manufacture depend greatly upon the kind of machinery in use, the statements made with regard to the one will naturally include figures with regard to the other, and for the purposes of this paper it will be necessary only to divide the subject into two sections—milling and diffusing work, and to consider each in detail.

Under the head *milling* we may proceed to state what has been done during this past year. An experiment of some interest was tried at the Eleele Plantation with a four-roller crushing mill of peculiar construction; the rolls were set in pairs, the line joining the centre of each pair of rolls being inclined away from the cane carrier

at an angle of about 45°. The object of this construction is to do away with the excessive friction due to the returner bar, and consequently to avoid the use of more steam than absolutely necessary. This mill was successful in the direction of using the minimum of power; it also took the cane freely in both pairs of rolls, but the angle of the rolls permitting juice to flow over and through them, and thus being re-absorbed by the megass or crushed cane, the mill was not put in use; we understand that alterations are being made which it is hoped will remedy the defects, and there is no doubt but that this style of mill will do as good work with less power than the three roll mills in common use. A six-roller mill is now in course of construction, to be used on this coming crop at Wailuku, Maui, the results from which will be looked for with interest.

Maceration, or the application of water to the megass between the rolls, has been used this past season to a greater extent than ever before in this country, and some places credit the process with a considerable increase in the output of sugar. We present herewith two statements—one of a trial run made at Hamakuapoko, Maui, and the other of the total crop taken off at Spreckelsville, Maui:—

RECORD OF TRIAL RUN AT HAMAKUAPOKO MILL, MARCH 22ND, 1890.

		lbs.
Cane worked up as per weights returned from Fairbanks' scale		434,050
Average fibre in cane at 10·2% on its weight		44,273
Juice contained in cane, 89·8% on its weight		389,777
Juice extracted from cane, 74·32% on its weight		322,586
Juice left in megass by balance		67,191
Water added in macerating per 100 normal juice	4·2	
Analysis of normal juice, Brix	18·45%	
Sucrose	15·7%	
Quotient	85·1%	
Glucose, ·62%; per 100 sucrose in normal juice............	4	
Analysis of diluted juice, Brix	17·7%	
Sucrose	15·0%	
Quotient	84·7%	
Glucose in clarifier juice, ·93%; per 100 sucrose	6·1	
Sucrose in cane, 14·1%		61,195
Sucrose in extracted juice		50,646
Sucrose left in megass by balance		10,549
Sucrose left in megass by analysis, 1·76 of sucrose in cane		10,770
Difference due to errors of observation		221

				Sucrose.
Commercial sugar recovered	A	32,890 lbs.	@ 97·1 pol. =	31,936·19
	B	7,910 lbs.	@ 87·7 pol. =	6,937·07
	C	2,207 lbs.	@ 84·0 pol. =	1,853·88
	D	860 lbs.	@ 80·0 pol. =	688·00
Total commercial sugar		43,867	94·4 sucrose	41,415·14

ABSTRACT OF LOSSES:

Loss of sucrose in milling the cane.................. 10,549 lbs. = 17·23%

Loss of sucrose in manufacture .... 9,231 lbs. = 15·12%

Total loss of sucrose calculated upon sucrose in cane ...... = 32·35%

STATEMENT OF RESULTS FROM ENTIRE CROP, SEASON 1889–1890.

HAWAIIAN COMMERCIAL CO.'S MILLS, SPRECKELSVILLE, MAUI.

Cane worked up in lbs 143,881,160

Average fibre in cane at 14% on its weight .... 20,143,362·4

Juice contained in cane at 86% on its weight................ 123,737,797·6

Juice extracted from cane at 72·5% on its weight 104,313,841

Juice left in megass by balance .... 19,423,956·6

Maceration was used intermittently and no especial record was kept of diluted juices as distinct from normal juice.

Water added per 100 of normal juice when macerating .. 11·2

Analysis of normal juice, Brix .... 19·62

Sucrose .... 18·00

Quotient .... 91·7

Analysis of diluted juice, Brix .... 17·36

Sucrose in the cane 15·48% on its weight................lbs.=22,272,803·6

Sucrose in extracted juice ....lbs.=18,776,491·4

Sucrose left in megass by balance.....................lbs.= 3,496,312·2

Commercial sugar recovered all grades........17,070,000 lbs.=8,535 tons.

Proportions A 83%, B 12%, C 4%, D 1%

Total sucrose recovered ....16,340,000 lbs.

Average polarization of commercial sugars ... 95·8 %

ABSTRACT OF LOSSES:

Loss of sucrose in milling the cane .... 3,496,312·2 lbs.=15·69 %

Loss of sucrose in manufacture .... 2,436,491·4 lbs.=10·9 %

Total loss of sucrose calculated upon sucrose in cane ..=26·59 %

The figures from which these results are worked out were, by the kind permission of Hugh Morrison, Esq., Manager for H. C. Co., copied from the chemical books of the Company.

It will be noticed in examining the figures from Spreckelsville that the recovery of sucrose in percentages on total sucrose in the cane nearly equals the extraction of normal juice in percentages on the

weight of the cane, it will be found that as a rule this proportion will obtain on the plantations in this country, and as this can easily be carried in the mind it will form a rapid method of approximating to the losses sustained during a milling season.

It has also been demonstrated during the trial runs at Hamakuapoko, Maui, that the addition of a small percentage of water in maceration is of no benefit, that no more saccharine matter has been extracted, and that the result has been to lower the purity of the juice without corresponding advantage; it would therefore seem that an addition of water of at least 10% must be made to secure any increase of production and that 20% would probably be more advantageous than 10%.

When macerating to the extent of 11·2% additional water to the juice, considerable outside fuel was used at Spreckelsville, based on the total crop the coal used was one-sixth of a ton to every ton of commercial sugar made.

It is a matter for regret that so few mills in this country keep a chemical record of their work; these records are of the highest value when systematically kept, and lead to discoveries of losses and leaks that are unknown otherwise; the apparatus is not expensive and soon repays itself in showing managers where prevention is needed.

Section Two—Diffusion: During the past year there have been three Diffusion Plants at work in this country, Kealia, Kauai; Hanalei, Kauai; and Hamakuapoko, Maui; the first-named has now completed its third crop, the other two were newly put up last year and were operated for the first time on this crop. There was a great deal of trouble experienced in the starting of the last two named places owing to structural defects, and also to the fact that the men in charge were new to the work; but after the first difficulties were overcome the apparatus worked smoothly and satisfactorily to the owners. A valuable experiment has been tried at Waiakea, Hawaii, on continuous diffusion applied to megass resulting from single crushing in a three roller mill; the ends sought however, were not obtained, and the apparatus has not been put to use; this settles the question of the practicability of attempting to diffuse the remaining saccharine matter out of crushed cane.

It would only take up valuable time to describe the diffusion machinery now in use in this country—that at Kealia, Kauaia, has been thoroughly described, and they all have the general features of that plant; it will suffice to say that the batteries of 14 cells are

arranged in two lines, that clarification is carried out thoroughly in the cells, the juice being discharged direct to the evaporators, the exhausted chips are conveyed directly to the mills, and, after passing through, are burnt on step-ladder furnaces; the slicing machine used is one that does the work of cutting the cane at one operation and delivers a clean cut slice, as has already been shown to be the correct thing; that the syrups are easily manipulated in the vacuum pans, and that the average polarizations of the sugars is raised nearly one degree, as is shown by the results from Kealia.

Following we present crop reports from Kealia, Kauai, and Hamakuapoko, Maui, and we wish to call your attention to the fact that all the statements made in this paper as regards sugar returns are based upon *the sucrose contained in the cane*, that being the only basis upon which any comparison can be made, or in fact upon which any reasonable estimate can be made of the losses sustained either in extraction or manufacture.

STATEMENT OF RESULTS FROM ENTIRE CROP, SEASON 1889-1890, MAKEE SUGAR CO.'S MILLS, KEALIA, KAUAI.

Cane worked up in lbs...............................		100,866,429
Average fibre in cane at 11% on its weight	=	11,095,307·2
Normal juice present in cane at 89% on its weight	=	89,771,121·8
Sucrose in cane at 15·14% on its weight..................	=	15,270,068
Sucrose extracted at 96·04% of sucrose in cane	=	14,665,373
Lost in exhausted chips 3·96 of sucrose in cane..........	=	604,695
Lost in exhausted chips ·6% of weight in cane.		

Average analysis of normal juice, Brix		19·12
	Sucrose..........	17·01
	Quotient	88·94
Average analysis of diffusion juice, Brix............		14·55
	Sucrose	12·76
	Quotient	87·7
Water added per 100 of normal juice..............		31·4

Commercial sugar recovered..	A	9,412,290	98·2 pol.	= 9,242,869
	B	2,933,770	94·9 pol.	= 2,784,148
	C	1,039,654	87·0 pol.	= 904,499
	D	274,775	84·9 pol.	= 210,361
Total Commercial Sugar....		13,633,489	96·4	Total sucrose, 13,141,877

ABSTRACT OF LOSSES:

Loss of sucrose in extraction......................	604,695 lbs.	= 3·96%
Loss of sucrose in manufacture and waste molasses..	1,523, 496 lbs.	= 9·97%
Total loss of sucrose calculated upon sucrose in cane......		=13·93%

Total fuel used in manufacturing this sugar cost $24,340·00 or $3·57 per ton commercial sugar; the amount of waste molasses per ton commercial sugar is about 16 gallons, no very accurate account was kept of this item.

STATEMENT OF RESULTS FROM PORTION OF CROP WORKED OFF BY DIFFUSION, SEASON 1889-1890, HAIKU SUGAR CO.'S MILL, HAMAKUAPOKO, MAUI.

Cane worked up in lbs.	14,589,625
Average fibre in cane at 11·3% on its weight	1,645,628
Normal juice present in cane at 88·7% on its weight	12,943,997
Sucrose in the cane at 15·7% on its weight	2,289,564
Sucrose extracted at 95·3% on its weight	2,181,601
Loss in exhausted chips ·74 on weight of cane =	107,963

Loss in exhausted chips 4·7 on sucrose in cane.

Average analysis of normal juice,	Brix	20·33
	Sucrose	17·92
	Glucose	·71
	Quotient	88·16
Average analysis of diffusion juice,	Brix	16·45
	Sucrose	14·39
	Glucose	·59
	Quotient	87·5
Water added per 100 of normal juice		23·6

				Sucrose.
Commercial sugar recovered	A	1,463,325	97·0 pol.	=1,419,425
	B	396,786	87·4 pol.	= 346,791
	C	140,360	86·7 pol.	= 121,692
	D	40,054	80·0 pol.	= 32,043
Total Commercial Sugar		2,040,525	94·1	Total sucrose, 1,919,951

ABSTRACT OF LOSSES

Loss of sucrose in extraction	107,963 lbs. =	4·70%
Loss of sucrose in manufacture and waste molasses	261,650 lbs. =	11·43%
Total loss of sucrose, calculated upon sucrose in cane	=	16·13%

Coal used in manufacturing this sugar was about $\frac{4}{5}$ ton per ton of commercial sugar, average cost of coal at furnace mouth may be placed at $10·50 per ton.

REVIEW OF THE LOSSES AS DEMONSTRATED.

Hamakuapoko Mill, milling with Maceration, total loss sucrose	32·35%
Spreckelsville Mills, milling with Maceration, total loss sucrose	26·59%
Kealia Mill, Diffusion, total loss sucrose	13·93%
Hamakuapoko Mill, Diffusion, total loss sucrose	16·13%

A simple and reliable formula for the calculating of quantities of additional water in maceration and diffusion juices, when the quantity of dilute juice is known and the quantity of normal juice is unknown, has been asked for and we present the following in the hope that it may be found useful.

Given the Brix reading of normal juice to find from a given quantity of dilute juice, the amount of water added to effect the reduction in density:—

Let x = Normal juice in lbs.
Let B^X = its Brix reading.
Let y = dilute juice in lbs.
Let B^Y = its Brix reading.
Let z = water of dilution in lbs.

$$\text{Then} \left\{ Y - B^Y \times \frac{Y}{100} \right\} - Z = \left\{ X - B^X \times \frac{X}{100} \right\}$$

$$\text{Hence } Z = Y - X$$

$$\text{and } X = \frac{B^Y \times Y}{B^X}$$

EXAMPLE.

Let it be required to find the weight in lbs. of the normal juice resulting from an hour's crushing with maceration; normal Brix is 19·5%, dilute juice weighs 45,000 lbs. and stands 17% Brix.

Then to find weight of normal juice per formula:—

$$X = \frac{17 \times 45000}{19 \cdot 5} = 39{,}230 \cdot 8 = \text{weight normal juice.}$$

$$Z = 45{,}000 - 39{,}230 \cdot 8 = 5{,}769 \cdot 2 = \text{weight of added water.}$$

Proof of this is that the actual weight of solids in both juices should be the same, therefore 17% of 45,000 = 19·5% of 39,230·8, which is the case.

This may be condensed into the following rules:—

To find weight of normal juice, Brix being given, from the weight of diluted juice.

Multiply weight of diluted juice by its Brix reading and divide the product by Brix of normal juice; result is weight of normal juice.

To find weight of added water, subtract the one from the other.

To find the weight of water required to be added to any given normal juice to reduce it to any given density, multiply weight of normal juice by its Brix reading, divide by the Brix of the required density, and subtract the weight of normal juice from that result; the remainder is the water to be added.

There is little to add to the foregoing except to notice the facts that

a Yaryan evaporator has been put into successful use; the superheaters for exhaust steam introduced last year have proved valuable adjuncts on many places, but we cannot fail also to notice that on some plantations the superheater has not proved of much value, owing, we think, to the low temperature of the gases at base of smoke stack; from observation we believe that if the temperature of gases at base of chimney is 500° Fahrenheit or more, then the superheater will do useful work in heating up exhaust steam and thereby economising fuel.

We also notice that high-class machinery for irrigating purposes has been put to work during the past year; the pumps are chiefly of American manufacture, and one of them uses the triple expansion principle in its steam end and develops a high duty from the coal burnt.

The progress made during the past year in improvements and processes is markedly satisfactory, but before we close we would call your attention to losses of sugar in manufacture; the juice delivered by mills or batteries contains a given amount of sucrose, of which on the average 10% is lost; where this loss occurs has never to our knowledge been exactly placed. Considerable inversion is known to occur during the crystallization, but that does not account for this large loss; some inversion occurs in cleaners and clarifiers, but not as much as popularly supposed.

It is thought, with some reason, that the condensers of triple effects and vacuum pans carry off some of this saccharine matter; and in carefully considering the matter, the overflow from evaporating apparatus seems to be the only place where these losses can occur.

In Australia and Germany they are careful to have very effective save-alls to their evaporating apparatus, due no doubt to their discoveries of loss in this direction. We wish to call the attention of mill managers to this point, and would suggest that efforts be made during the coming season to determine for certain whether loss occurs in this direction or not.

In view of the proposed changes in the Tariff Bill in the United States, we would urge upon all those interested in mills to locate losses; thousands and thousands of dollars have been thrown away owing to defects in machinery and methods, all of which might have been saved had some system of checking been in use.

H. P. BALDWIN,
Honolulu, October 6th, 1890. J. N. S. WILLIAMS.

RESULTS OF THE CAMPAIGN OF 1888-89 IN THE GERMAN SUGAR FACTORIES.

We have hitherto been unable to give these results as they have not yet appeared in the *Deutsche Zuckerindustrie*, owing to press of important matter. The author of the pamphlet from which we have taken the following figures, and for which we are indebted to the courtesy of the Editor of the aforesaid German periodical, excuses the late appearance of his statistical tables by the necessity which he has been under of deriving the results of the working of the various factories from all sorts of newspapers and publications, owing to the difficulty experienced in obtaining information direct from the factories. And this is not to be wondered at, seeing that the managers and officials of those establishments, who are now so strongly protesting against the new legislation proposed by the Government, are beginning to see that it is a feather from their own wing that has guided the arrow launched against them, that the statements which many of them have so freely published have been used as the material for justifying the curtailment of their profits now proposed.

With regard to the results of the campaign, the following are the remarks of the author, written before the publication of the Government proposals :—

"The results of the campaign of 1888-89 can only be regarded as satisfactory. The beets were fairly rich in sugar, and prices were all that could be desired. Some factories stored their sugar, and in consequence of the wild rush of prices in March to July, an unusually large profit was made. The new sugar legislation was put in force for the first time in this campaign. Like all new legislations, its introduction gave rise to many mistakes and misunderstandings.

"In spite of interested reports of the great extension of the sugar industry in North America, we have as yet nothing to fear from that quarter. Above all things in America there is a deficiency in cheap agricultural labour, without which beet cultivation cannot succeed. France, however, bids fair shortly to surpass us, thanks to the support afforded to the farmers by the State, and to remarkable technical progress, by means of which the yield of sugar obtained was raised in one year from 6% to 10½%."

We have given translations of nearly all the explanatory remarks added in the tables, although it is not always easy to see what is their exact object.

Name.	Share Capital.	Price of Beets per centner.	Cost of Working per centner.	Profit.	Loss.	Remarks.
	Marks.	Pf.	Pf.	Marks.	Marks.	
Aderstedt	989,625	117	42·5	8,836	..	
Algermissen	450,000	102	46·7	76,003	..	Manoury Elution.
Altfelde	600,000	..	..	22,702	..	
Alt-Jauer	1,500,000	97·2	87·9	265·460	..	Refinery and large farm attached.
Anclam	500,000	90	32·4	152·999	..	
Alsleben a S.	437,354	108	40	54,808	..	
Badersleben	475,550	90 (?)	39	262,132	..	
Bedburg	660,000	103	49·3	94,511	..	Steffen's process.
Bernstadt	705,000	90·56	46	39,684	..	
Bölingen	1,085,714	..	..	108,276	..	
Bredow	1,200,000	100	54	128,412	..	
Brehna	412,000	107·7	38	122,585	..	
Brühl ...	1,050,000	118	50	254,750	..	Steffen's process.
Bennigsen	683,100	..	..	93,890	..	
Cöunern	180,000	110	50	50,584	..	
Culmsee	1,300,000	84·4	46·01	126,596	..	Maltose factory.
Ceres Dirschau	600,000	90	38·7	25,050	..	
Dettum	300,000	98	49	133,194	..	
Dingelbe	420,000	120 (?)	(?) 58·8	..	..	
Dirschau alt	450,000	..	..	79,042	..	
Doebeln	690,000	99·76	48·7	142,522	..	
Droebel	150,000	109	35	110,039	..	
Dinkbar	297,660	100	..	..	..	
Eilenstedt	600,000	..	..	124,482	..	Large farm attached.
Emmerthal	790,500	..	..	33,416	..	Elution.
Etgersleben	219,600	100	56·4	16,721	..	

Erdeborn	264,000	82·9	44·7	177,411	..	
Fallersleben	804,750	110 (?)	35 (?)	264,917	..	
Frankenstein	526,000	104	45·2	22,829	..	
Franstadt, with Gr. Glogau, and Nenkersdorf	1,800,000	..	..	542,571	..	
Gandersheim	443,400	92·1	58·5	18,200	..	
Glauzig	4,500,000	99	64·4	396,740	..	
Görchen	500,000	102	45·1	..	53,070	
Göttingen	259,000	98	61	11,388	..	
Gr. Düngen	540,000	95·9	43·3	62,990	..	
Gr. Gerau	530,000	..	..	218,509	..	
Gr. Ammensleben	320,000	115	38	9,801	..	
Güstrow	831,590	97·5	43·7	64,597	..	Has diminished its debit balance to M.205,645.
Hadmersleb	780,000	..	..	100,456	..	
Haynan	800,000	99·3	38	96,921	..	
Hecklingen	214,000	125 (?)	61 (?)	..	..	
Hoiersdorf	297,000	100 (?)	63·6	30,186	..	
Holzminden	344,400	87	73	..	..	
Hornburg	394,500	..	..	96,411	..	
Heilbronn	1,660,000	110·8	..	301,316	..	Refinery and large farm.
Hirschfeld	..	75	87·8	11,247	..	
Holland-Cöthen	630,000	94	..	385,573	..	Refinery and large farms.
Immendorf	330,000	106	50·3	173,011	..	
Kl. Wanzleben	2,700,000	96	135	144,602	..	Elution. Large seed growers.
Königslutter R. & Co.	592,500	86	40·6	(?)	..	
Körbisdorf	2,700,000	96	32·5	222,384	..	Large farm and coal mines.
Kosten	917,500	98·7	..	239,624	..	
Klützow	855,000	96	38	199,532	..	
Kruschwitz	1,500,000	83	39·0	219,096	..	M.211,111 to clear off old debit balance.
Kujavien	900,000	..	..	157,879	..	
Lage	625,000	100	40·9	56,000	..	
Langenweddingen	240,000	..	..	41,033	..	

Name.	Share Capital.	Price of Beets per centner.	Cost of Working per centner.	Profit.	Loss.	Remarks,
	Marks.	Pf.	Pf.	Marks.	Marks.	
Lehrte	263,400	..	..	8,780	..	
Löbau	1,200,000	..	..	125,452	..	Makes grocery sugar.
Maingau	702,000	..	..	33,427	..	Steffen's process.
Makranstädt	450,000	90 (?)	(?) 45·2	82,788	..	
Malchin	600,000	100	54	119,661	..	
Mescherin	596,000	..	..	80,264	..	
Melno	594,500	78·8	41	..	..	
Münsterberg	600,000	107	55·6	149,120	..	
Marienburg	460,000	..	..	74,118	..	Debit balance, M.260,211.
Mattierzoll	342,000	115·6	40	119,688	..	
Neuhaldensleben	900,000	100 (?)	39·2	..	..	
Niederndodeleben	450,000	94	54·8	25,293	..	
Neu-Schönsee	600,000	80·4	59	325	..	Debit balance, M.45,960.
Niederhone	460,000	100 (?)	58 (?)	134,576	..	
Neuteich	600,000	84·8	44·4 ?	88,179	..	
Offstein	211,200	109	59·3	77,162	..	
Oldesloe	581,500	75·8	112·6	..	59,454	
Oestrum	363,500	97·8	47·3	8,219	..	
Oldendorf (Hessen)	422,400	92	61	..	7,297	
Opalenitza	1,100,000	110·5	32·3	205,578	..	
Oschersleben A. G.	720,000	..	38·09	..	..	
Ottleben	336,000	110	52·9	43,673	..	
Ottmachau	750,000	91·6	42	139,590	..	Large farm.
Pelplin	600,000	96·5	45·1	38·027	..	
Rhein. Act. — Verein, Cöln, Dormagen and Dessau	6,000,000	..	..	..	287,577	Three refineries and raw sugar factory.

Reisenburg	560,000	62·6	94·6	37,142	..	
Sehnde	520,200	99·4	54·3	483	..	Elution.
Schladen	800,000	104	100	324,269	..	Elution.
Scheune	476,000	..	..	..	24,446	
Schoeppenstedt	399,000	(?)100	..	212,396	..	
Sobbowitz	591,000	87·3	52·0	3,026	..	Elution.
Strassburg i. U.	750,000	95·5	62·4	238,308	..	
Schwetz	790,400	..	..	..	22,809	
Soest	1,200,000	111	..	75,573	..	
Stavenhagen	761,400	..	..	47,778	..	
Tiegenhof	492,600	..	..	..	75,583	
Thiede	.....	..	..	..	..	
Trachenberg	1,200,000	110 (?)	63·8	207,000	..	Osmose.
Tuczno	600,000	100	44·8	46,371	..	
Ummendorf	372,600	101	41·9	5,041	..	
Unislaw	429,600	80 (?)	42	76,630	..	
Uslar	360,000	98	53	1,035	..	
Vechelde	300,000	97	48·3	64,384	..	
Vienenburg	499,000	105	48·7	65,548	..	
Wabern	600,000	102·3	..	..	..	
Wendessen	367,500	100	33	246,023	..	
Weetzen	750,000	130·79	32·9	..	..	Profit distributed in payments for beets.
Weissenfels	225,000	90	41·4	43,579	..	
Wetterau	835,200	95 (?)	(?) 42·7	158,568	..	
Wevelinghoven	600,000	101	57	176,447	..	
Wreschen	675,000	101	39·1	32,965	..	
Wegeleben A. G.	1,248,000	100 (?)	56	395,829	..	Elution.
Zduny	900,000	105·7	37·5	85,740	..	
Zülz-Schönowitz	814,200	105	33·1	62,372	..	

N.B.—The somewhat frequent use of a note of interrogation indicates the difficulty of arriving at exact figures, which we have more than once referred to in our remarks upon the published statements of results obtained in the German factories.—(ED. *S. C.*)

MAURITIUS.

Some of the editorial staff of the Philadelphia *Sugar Beet* have lately visited this colony, and have collected a large amount of information. It is always instructive to hear what others say of us, and so we propose to reprint a considerable portion of the very intelligent remarks on the sugar cultivation of the island, though not quite agreeing with some of the deductions which our American friends have drawn. And it is possible that our Mauritius planters would scarcely admit the perfect accuracy of all their statements. A certain amount of error is, however, almost inevitable in speaking of a country in which the writer is not a resident. The paper is entitled

A Visit to Mauritius.

We learn from official sources that $30,000,000 are invested in the sugar industry of the island, representing half that of the entire West Indies. In the latter, sugar plantations have, from a financial point of view, been for years in a very sad condition; most of such plantations being heavily mortgaged, &c. This is not the present situation at Mauritius; on the contrary, improvements are being urged, and a desire to keep up with the progress of the hour, is more strongly felt from year to year. It has been suggested that prizes be offered for the most improved methods of extraction.

While beet sugar processes have advanced steadily towards perfection, cane sugar methods have undergone very little change. During the agitation created by the West India sugar growers, combined with British refiners, to have drawbacks suppressed, Mauritius planters took no notice of the same, but continued their routine work. It is said that the home government, while sending out communications to all countries—whether interested in sugar or not—neglected to invite views of Mauritius sugar manufacturers.

The fall in price of sugar throughout the world, owing to beet sugar competition, had important influence on the energy of planters. While this depression of prices has continued, the consumption has increased and been met by an increased production. The prices of sugar being variable, have not affected in any way those factories having limited capital and good management. The most important

sugar buyer of the island purchases for ready cash when a favourable opportunity offers; but those who are simply commission merchants are at a disadvantage.

It frequently happens that ships with cargoes arrive at Mauritius, and after waiting for a considerable time, are about returning to their starting point, when reasonable shipping terms may then be made; and the profits in an Australian or Indian port are considerable.

During our visit to Mauritius the campaign 1889-90 had nearly terminated. The total sugar manufactured was greater even than it had been for many years past; and an increased exportation to India continues. As for Great Britain, the falling off has been 50 per cent. during the first six months of the foregoing sugar campaign, as compared with 1888-89, 1887-88. Shipping in the direction of Australia has also increased very considerably.

The movement of sugar from Mauritius has not been falling off, as is frequently asserted. Once there were many more vessels in port at the same time than there are at present; but this is explained by the fact that steamers have now the carrying trade instead of sailing vessels, as formerly. The value of sugars exported may be estimated at over $10,000,000. The main centres are India and Australia. During 1888 the total sugar made and shipped in Mauritius was 130,066,518 kilos., of which 65,986,606 kilos. were sent to India (mainly Bombay), and 31,601,956 kilos. to Australia; to England, only 11,953,148 kilos. The *United States* received 6,269,837 kilos.; * Ceylon, Hong Kong, Madagascar, &c., are centres receiving varied amounts of Mauritius sugar.

Small quantities of sugar candy, refined and raw sugars are imported. The raw sugars from Johanna amounted to 853,000 kilos. The duty during 1888 was $4·75 per 100 kilos. All sugar candy and refined sugar imported was entered for consumption. On the other hand, only 601, kilos. of the imported raw were consumed; the remaining 84,000 kilos. are said to have been reworked in factories. Our visit to Mauritius was in January of 1890. Only certain portions of the crop remained to be worked. It is, however, interesting to compare the exports at that time with corresponding period of previous years. The data given herewith relate to the crop from August 1st to January 7th each year:—

* Kilos. may be easily converted into tons by striking off the last three figures.

	1889-90. Kilos.		1888-89. Kilos.		1887-88. Kilos.
Great Britain	1,125,758	....	2,506,903	....	2,924,595
Countries of Europe..	3,183	....	2,136	....	3,378
America	....	....	1,802,538	....	....
India	32,533,173	....	26,793,399	....	28,837,104
Australia	19,237,551	....	13,137,714	....	10,824,852
New Zealand	4,452,871	....	3,396,283	....	2,762,578
Cape of Good Hope..	4,941,513	...	3,507,448	....	1,619,086
Other places........	476,032	....	2,181,065	....	356,528
	62,770,281		53,328,386		47,328,121

The yield of Mauritius sugar per acre is marvellous, and at first sight would have a very discouraging effect upon one about to invest capital in sugar enterprises in the United States. We learn that such and such a manufacturer extracts 9 or even 10 per cent. sugar from his canes, and that the sugar yield is from 5,000 to 6,000lbs. per acre. We contrast these results with those of other cane-growing centres, and at once conclude that owing to a recent general use of *triple effects* and vacuum-pans, combined with many other improvements introduced of late years, the yield has been doubled (?) Progress in the past is only one step towards perfection, and technical skill and management of the future may still further increase the quantity.

These results, compared with those obtained on an average beet plantation, appear greater than they actually are. Those with whom we have discussed the matter, assert that cane sugar in Mauritius is at present made at much lower cost than continental beet sugar. This may be true for certain grades, but not so when the expensive machinery, &c., are considered. Certain coal and other fuel will cost much more on the island than in France or Germany; but the low price of labour may equalise it.

On the other hand, it should be remembered that in beet-growing districts land is constantly ameliorated, and increased value of real estate in the vicinity follows; also profits from fattening cattle, resulting in an ample supply of barnyard manure and bagasse—the latter used for fuel. But on a Mauritius plantation there is produced very little manure, and there are no fattening profits; the exhaustion of the soil is very apparent on thousands of acres of land of the island. The system of land lying fallow, an outcome of necessity, means

capital remaining idle for a period of years. These are a few of the many arguments we could advance against cane growing and sugar-making profits in this island.

If we admit that 5,000lbs. sugar per acre is an average in Mauritius (?), this is obtained after 20 months from time of first planting; after the third year the yield is 3,000lbs., fourth year 2,000lbs., a total of 10,000lbs. Then follows a rest of one or more years: consequently, during a period of five years the average annual production per acre is about 2,000lbs. When planters speak of sugar they do not mean high grade, white sugar, as is the case when discussing beet sugar, but, on the contrary, the yield is made up frequently of five grades.* If this be reduced to a uniform grade of refined sugar, as it is on the European sugar market, the average extraction for the entire island will not be 7·2 per cent. The sugar is not more than 3-5 extracted; and if by diffusion or any other method the entire quantity is obtained, it is doubtful whether the extraction will reach 13 per cent., as is the case in many German beet-sugar factories.

There appears here a paradox, as the purity co-efficient of cane-juices is higher than with beet juices. Since improvements in sugar making require large capital, and as Mauritius capitalists are not anxious to risk money in new ventures of any kind, it is doubtful if any great change be made, on the greater number of estates, for many years to come.

In beet-sugar making there has been a steady progress and it is stated by some that the maximum has been attained; but this is by no means the fact, for beets in California of 17 per cent. sugar are very common, and there is no reason why such yield may not be an average at some future day. Cane selections and amelioration are the main points which beets will have to contend with before many years are past. In the meantime beet sugar will hold its own against tropical sugar competition. This is made evident when we consider, that with due allowance for rotation of crops, hundreds of acres of land in California have averaged 2,500lbs. of sugar for many years. With proper care the same soil has been used year after year without any signs of deterioration.

* First, 64 per cent.—first syrup, 13 per cent.—second syrup, 9 per cent.—third, 12 per cent.—fourth, 2 per cent.

It is to be regretted that so few factories of Mauritius employ chemists, as is so customary in all important beet-sugar factories; the planters too frequently look upon these questions of science as having little practical value. We venture the assertion that important progress will not be made until the entire sugar manufacture is in the hands of men who have made the chemistry of sugar a special study. Every detail, from the mill to the very last process, if worked according to technical rules of laboratory control, would pay several times over the salary of an expert. We could cite one case in Mauritius, where the sugar extracted had for years been only 6 per cent., but when worked according to laboratory tests, &c., it yielded 9 per cent.

The so-called creole declines working in sugar factories; the experience of planters here is exactly the same as that described in a letter from West Indies to *Sugar Beet* some years since. Labour is imported from India; a system of contract for several years with wages at $2 to $3 a month, but the workmen are taken care of, fed, clothed, housed, and furnished with medical attendance. These labourers may, when the contract expires, either return to India or remain on the island; many remain, and whether this is a mistake is a difficult question: one fact is certain, they do not have the best of influence on new comers.

During their working hours the men render excellent service and appear faithful and steady. Some of them are able to handle vacuum pans with great success; this and other work seems to suit them. A mystery in many cases is, how and where they obtain the technical skill they appear to possess in an emergency. Every detail under the guidance of a single European is in their hands. In most cases factories do not run at night, if they do the hands receive extra pay. It has been, in most cases, difficult to have separate gangs of men for night and day work. The Sunday law at Mauritius is certainly very unique; but few, if any factories work on that day, if they do they are liable to a fine. The loss of the owners from this is considerable; if, for example, the mill is run within the limits of 120 days, there are 12 Sundays, and if 50,000lbs. per diem are produced the loss for the campaign is 600,000lbs.

(To be continued.)

NEW AUTOMATIC-FEED CANE-SLICING MACHINE.

We have pleasure in calling the attention of our readers to a new machine for the above purpose, invented and being manufactured by the Sangerhäuser Aktien-Maschinenfabrik und Eisengiesserei (formerly Hornung and Rabe), of Sangerhausen, Germany. This company has supplied diffusion batteries for a considerable number of the larger cane-sugar producing colonies, and, after many efforts to simplify the machinery required in the diffusion process, has now succeeded in designing a cane-slicing machine, to which the cane will be fed quite automatically by means of a common cane carrier, in the same manner as to the sugar cane crushing mills.

This machine will, in one operation, produce regular slices—no pulp or shreds—the shape of which will, besides securing a perfect extraction of the sugar, permit of a satisfactory defecation of the juice in the diffusors, thereby enabling the cane sugar manufacturers to dispense with the use of defecators, eliminators, settling tanks, mud presses, &c.

The new cane-slicing machine consists essentially of a horizontal shaft, on which are mounted three conical cutting drums, each provided with 12 cut-away openings for inserting the knife boxes. The feeding hoppers, one to each cutting drum, appear, when viewed from above, as lying parallel to each other. They are inclined towards an imaginary horizontal plane, passing through the centre of the cutting drums, and are all of the same size and shape, their position being such as to cause the sugar cane to slide automatically from their highest point down to the outer conical portion of the cutting drums.

The feeding hoppers are, in an arched way, elongated by means of obliquely arranged shutes, extending at the same angle as that formed by the feeding hoppers with regard to a horizontal plane, in such a manner that the upper edges of the shutes will form one horizontal line at their highest point, where the cane carrier discharges the cane.

The company are at present busied with the construction of two complete diffusion plants for a day's work of 400 English tons of cane each, to be erected in the Hawaiian Islands. Mr. Alexander Young, manager of the Honolulu Iron Works Company, to whom one of these plants is being supplied, visited the works a few weeks ago,

after his having carefully examined the practical working of the various types of cane cutters in use in the Hawaiian Islands and Louisiana, as Williams's, Ross's, &c., besides the company's own former construction of slicing machines with horizontal cutting disc, and he at once gave preference to the new machine above described, as he considers it the most perfect system of slicing cane for the diffusion process. Two of these machines will be furnished with each plant.

INDIA.

THE SUGAR INDUSTRY.

Apropos of Mr. George Stade's pamphlet on the "Cost of Production of Beet Sugar," which appeared in the *Sugar Cane* for August, the *Rangoon Times* has some very interesting and well put remarks on the state of sugar cultivation and the sugar industry generally in India. The religious difficulty has played some part in the peculiar position of the trade, and explains some of its anomalies; this fact is not alluded to by the writer. There is, however, no doubt that the question of how so valuable an industry, for the development and successful carrying on of which India is above all other countries adapted, can be encouraged and made what it ought to be, is one which the Indian Government cannot much longer afford to overlook, on peril of being justly accused of indifference to the welfare of the great country whose interests it is called to watch over.

One thing we would like to point out, viz., that the opening remarks of the following extract are in no way justified. Mr. Stade does not represent any firm, and is not the advocate of or under obligation to any special manufacturer whatever. The assumption (in the clause which we have put in italics) is a totally incorrect one, and is not warranted by anything contained in what Mr. Stade has written, as any one may see by referring to the text of his pamphlet in our August issue:—

"We need hardly enter here into details of the manufacture of beet sugar, much as we are tempted to do so, in order to show that Mr. Stade's predictions of large profits by the selection and use of modern labour-saving apparatus, *of course through the agency of the firm he represents*, must be taken *cum grano salis*. What, however, we would like to draw attention to, are the very remarkable features of the sugar trade in India. Most of our readers are aware of the

great predilection for sweets shown by the natives, be they natives of Burmah or India. It will, therefore, be readily conceded that the demand for sugars, coarse or refined, raw or crystallized, is very great in our Indian Empire. Nearly every village has its date, palmyra, and cocoanut palms, and at the manufacture of *jaggery*, or raw unrefined sugar, the natives are great adepts. Again, every village has its *moira*, or sweet-meat maker and vendor, and no article of local consumption pays more *octroi* in the towns of the interior than does *goor* or *sucker*. It has been estimated that as much raw sugar as is exported from India is consumed in it, in addition to what is imported. And herein lies one of the anomalies of this branch of the Indian trade which we refer to. The imports of sugar continue to be on a very large scale. Last year there were imported nearly 13·4 millions of hundred weights of this article, the declared value being just 22 millions of rupees. Of this quality some 2½ millions' worth was re-exported. So that, in addition to what was locally raised, India consumed something like 19½ millions of rupees' worth of sugar. This sugar was brought to India from all parts—from China, the Straits, Ceylon, England, Germany, France, Belgium, and Austria. And the bulk of the imports into Bombay was refined sugar. Now, refined sugar is manufactured in India. There is the Aska factory in Ganjam, the Cossipore factory in the suburbs of Calcutta, the Rosa factory at Shahjehanpore, and the Ashtagram factory in Mysore. Surely these are fully capable of supplying Bombay with the refined sugar she imports. These factories use sugar cane, instead of date-juice, and no beet, that we are aware of, is utilized in India for the manufacture of sugar. The produce of the Indian factories has received honourable notice at Exhibitions in Europe; and, if we are to give our personal experience in the matter, it must be acknowledged we have not seen the loaf sugar of the Cossipore and Rosa works surpassed. Besides this, while we take in refined sugar at one side of the Indian Peninsula at Bombay, on the other side from Madras and Calcutta, we actually send out refined sugar to the United Kingdom and Ceylon. Bombay receives refined sugar from both these countries—from Ceylon as well as from the United Kingdom. Why should this be? If ever trade presented anomalies, which the Government should look into and cause to be removed the sugar trade does, and it is to be hoped the department of Trade and Commerce in India will bestow some attention to these anomalies and

endeavour to remove them. The export trade of India in sugar has not yet recovered from the blow dealt by competition with European beet sugar. The refined sugar branch has been slowly but steadily declining. At one time the Indian exports used to come up to over 200,000 cwts., and though last year these exports were over 100,000, the year before that and for some years previously the exports did not exceed 38,000, and one year they were below 25,000 cwts. There can be no doubt that the beetroot sugar industry in Europe, fostered as it is by bounties, has brought down prices to a ruinous level. Looking then to all these circumstances we would ask what our Agricultural Department is doing in the matter? There exists a great demand for sugar in Burmah. The Burmese are quite as much given to sweetmeats and sugar—refined or unrefined—as the natives of India. Besides, the sugar cane can be very well grown in different parts of the province. We know of one part at least in Hanthawady where an acre has yielded an average crop of cane over a ton in weight. It is true there are difficulties in the way of establishing the sugar industry in the province, but these difficulties are not such as cannot be surmounted. The thing is to take up the matter with a view to obtain success in a proper way, and at reasonable expenditure of money. Is our Agricultural Department doing anything to establish a sugar industry in this way?"

SEEDLING SUGAR CANES IN MARTINIQUE.

After having been for more than a century considered as an insurmountable difficulty, it has now become an ordinary occurrence to cause the seeds of the cane to germinate and sprout. "It is such an easy matter," said one of our large planters to us the other day; "but I am going to make sowings on a large scale." What gave rise to this exclamation was an earthenware pot in which a small portion of a cane-arrow just covered with earth was germinating, and throwing out, at twenty-five or thirty different points, the small green leaflets which form the embryo canes. For this complete demonstration of the fertility of the cane seed, a proof evident which we hold at the disposal of the public, we are indebted to MM. Littée frères.

It will be remembered that MM. Littée were the first in Martinique to obtain wild seedlings of the cane. For more than a year we had,

Cassandra like, been prophesying this discovery, as we thought, uselessly, when one day we were informed that in consequence of the hint given by us, the proprietors of the Morne Etoile plantation had met with wild cane seedlings, had collected and tended them, and were already able to produce them in a state presenting all the external aspects of the grown plant. This was a great encouragement to us. Since then, following out hints which we were only too glad to supply to the planters, MM. Littée have, with the intelligence and method which characterise them, made sowings, and now, in the gardens of their magnificent estate Parnasse, one may count by thousands the little plants springing from seed. We are really delighted to make the announcement. In common with all those who are pursuing the study of this interesting question, whose labours we follow with earnest attention, we believe that the future of our country may be improved, and that at no distant date, by the selection of these plants. We have in less than twenty years seen the beetroot advance from 4½ to 11 and 12 per cent. of sugar yield. This improvement has been due to selection of seed. We may then very reasonably hope for analogous results, requiring possibly a longer time to obtain, because the cane from seeds is, with rare exceptions, two years before it flowers; but we shall succeed all the same, for the result of the experiments of two years is to show that the marked tendency of the seedlings is in the direction of the improvement of the kinds.

We must not deceive ourselves; it is for us a question of life and death to produce a greater quantity of sugar for the area planted than we now produce. Only a short time ago it was possible to believe that the richer quality of beets was only produced at the expense of the cultural yield. The experience of last year in France is calculated to remove this misapprehension; the average yield of the beetroot per hectare was very near 35,000 kilos. (about 14 tons per acre), the average saccharine content was 10½ per cent. of refined sugar. With our average yield of 8 per cent. of sugar of all jets, we require to produce on the average 45,500 kilos. of cane per hectare (18 tons per acre), or even 57,000 kilos. Is this average attained by us? Besides, with the marked tendency shown by the States towards protectionism, it may be feared that our products may some day have no other outlet than the national market; if the conditions were to remain as at present, we could not possibly keep up the contest, and our country

must succumb. All of thus then, who are interested in its maintenance and prosperity, must seek every means of reaching this end. The selection of canes is one of these means, and we must try it.

It must not be supposed, from what we have written at the commencement of this article, that it is so very easy to raise the young plant. In agreement with the remarks of all those who have taken up this pursuit, Mr. O. de Laguarigue, of Survilliers, tells us that the difficulty is, on the contrary, considerable. It is true that here the cane seed is, in certain cases, surprisingly fertile, but how small and delicate is the embryo of the great bushy plant, how many precautions have to be taken to preserve it from danger of destruction, and in spite of these precautions, what a vast number perish! No matter; the seed is not rare; it costs nothing; and care and trouble count for nothing in face of the greatness of the end to be attained.

Other countries have preceded us in the path of progress. For the last three years in Barbados, for two years in Demerara, for a year in Trinidad, they have been studying the reproduction and the scientific improvement of the cane from seed, and the results are most encouraging. The Syndicat des Fabricants de Sucre de la Martinique will permit us, as a matter of general interest, to publish the study of this question which we are making for them from the documents which reach us from the countries just enumerated. And it will be seen what faith in the future animates the distinguished scientific men who are endeavouring to èffect, without enthusiasm, but with an unshakable conviction, the renovation of the cane sugar industry on the same basis and by the same means which have made the beetroot our formidable competitor. And the English colonists will find amongst us a large number of imitators.

It is desirable that the conclusive experiments of MM. Littèe fréres should be more or less repeated everywhere; the multiplicity of the experiments will hasten the solution of the problem. The variation of the cane reproduced from seed is infinite. It is possible that chance may give rise, in different parts of the colony to different species, superior to those which we possess. To finish the article we will quote a fact which comes to us from the Director of the Botanic Gardens at Demerara, which can only encourage the trials which we are speaking of.

The *Scard* cane is a product of chance, the outcome of which is unknown. It is one of the first wild canes discovered by Messrs.

Harrison and Bovell at Dodd's station. Taken to Demerara it has been cultivated there, and constitutes an absolutely new variety and a giant of its kind. Some months ago it gave way under its own weight, and ten canes were broken in the fall. Deprived of their leaves they weighed 122lbs. In spite of this loss the stool is still 18 feet high and 12 feet in girth, and contains 24 canes, which are calculated to weigh 200lbs. without reckoning that half as many stems have been destroyed by the borer, which is remarkably abundant this year in Demerara.

There is nothing to prevent what has taken place in Demerara from happening here, and the happy possessor of as fine a specimen as this would be able promptly to renew the whole of his plantations from the first wild one met with. It is worth the trouble of trying.

(Later.) We have received from Mr. O. de Laguarigue, of Survilliers, Director of the Laboratoire des Usines du Nord, several cane seeds in full germination, along with valuable notes on the process and the first stages of the plant, together with very interesting sketches taken from microscopic observation.—(*Le Propagateur de l'Isle de Martinique.*)

PORTO RICO.

DIFFUSION *v.* VACUUM PAN AND TRIPLE EFFECT.

We are indebed to an obliging correspondent for the following account (which has already appeared in the *Deutsche Zukerindustrie*) of the present state of matters in this island:—

A continuance of the present low prices will induce many a small muscovado or concrete sugar manufacturer, whose products are far more difficult to dispose of than those of the centrifugal works, to take serious thought as to whether he could not in future do well to join his neighbour in working up their joint crops into crystals in a central factory.

People have already arrived at the conviction, by seeing the satisfactory work done by vacuum and triple effect in some dozen works (out of 200 establishments, large and small), that nothing but the speedy introduction of modern apparatus can save them from final ruin, and that the working up in vacuo of juice containing a large proportion of invert sugar constitutes a more important question than even the introduction of diffusion. They have been made distrustful by the very doubtful results obtained in various colonies with the

latter system, and they are much less enthusiastic in the matter than they were some years ago, when various machinery firms promised to overcome easily all difficulties. On the whole, it is in many cases not so much the technical difficulties which stand in the way of the general introduction of diffusion, as the dissuasive answer to the question whether with a cheap and abundant supply of cane the profit attending a more complete extraction is large enough, when against this has to be set the disadvantage of having to evaporate a much greater quantity of water (which means using more fuel), than by the old process, which might run away with the whole of the profits. It is not possible, or at any rate only possible with a large outlay, to arrange a plant which will work the diffusion process without a considerable addition of fuel to the bagasse, so that the profit of the greater yield in sugar is mostly swallowed up by the extra fuel, to say nothing of any sinking fund. In many of the West India islands, and also on this, the quantity of wood available is calculated to suffice for only a few lustra. Following out the principle, which is not unknown here—of *après nous le déluge*—they cut down continually and plant nothing.

Besides the firewood required for the engines, great gaps are made in the woods by burning the coral limestone for the defecation of the juice. But, to return to diffusion, if people are inclined to lay out capital, it will, in my opinion, with cheap cane, pay better to increase the turn out, that is work up a larger quantity, than to think of saving the very cheap and abundant raw material, which can only be effected by a greater expenditure of fuel. I may remark that we could buy cane here *ad libitum* at eight to ten shillings a ton, delivered in carts at the mill, were it not that we are able to produce 40,000 to 50,000 tons on our own plantations. And the cane in this virgin soil polarises nearly 18% in the juice, with an average specific density of 1·08.

An improvement in the yield naturally goes hand in hand with the installation of a new mill for increasing the quantity worked up; with good mill work nearly as large an extraction is attained as by diffusion, and at the same time the juice is more concentrated, and the remainder of the capital at disposal can be applied to improving the evaporating plant, which will pay for itself by economy in fuel, whilst if diffusion is adopted the mills are still indispensable, and in some cases even have to be renewed to clear the residues of diffusion of their water

by double crushing, for without this process they cannot be employed as fuel. Besides, the evaporating apparatus must be increased in order to deal with the greater quantity of water, which, along with a large outlay of capital, results in an increased consumption instead of an economy in fuel.

In making these remarks, I have tacitly assumed that the diffusion system has answered every expectation. But it cannot be denied that this new system has also its unsatisfactory side. As a European sugar maker, I know very well that in diffusion the extraction cannot be carried to the extremest point without injuring the quality of the juice, and that the dilution of the juice also has its practical limits on account of the increased evaporation, it is therefore of no use to calculate the yield of sugar with the figures which are given with the object of recommending diffusion. In practice, and where paying work is aimed at, only a small economy of cane is attained with diffusion (as I will proceed to show) with an equal amount of sugar production, as compared with good mill-work, and therefore I repeat, that when cane is cheap and abundant, the adoption of apparatus which is so dear and requires such great care and experience as is the case with diffusion is decidedly not advisable. I admit that if defecation in the diffusers should turn out to be really practicable, a great simplification of matters would be attained—the dispensing with defecators, clarifiers, eliminators, &c., would certainly be a grand step in advance—but I hear from one and another of my friends who are employed in South America, the Greater and Lesser Antilles, that this defecation in the diffusers is rather less perfect than that in the defecating pans, and that in consequence a good deal of dirt is carried into the evaporating apparatus, which, according to experience, is much more difficult to get rid of with cane than with beet juice, as the former produces a very hard crust. One of my friends in the Lesser Antilles has had as much as 5 mm. of hard incrustation ($Si\ O_2$) in a week; by boiling several hours with caustic soda and afterwards hydrochloric acid (50 litres per 2 cubic metres of $H_2\ O$), the crust was so far dissolved that it could be removed by steel brushes.

The reason of the defecation in the diffusers being less perfect than in the defecating pans is to be found in the reduction of the temperature of the juice, which is caused when the latter comes into contact with the fresh chips (to which the milk of lime is added for defecation) in the mashing. Such a low temperature renders good defecaiont

impossible. If the juice is drawn off as soon as mashed, it leaves the diffusion battery without being perfectly defecated, even though it has a clear appearance in consequence of filtering through the chips. As soon as this juice gets into the evaporating pan and becomes hot, it throws down scum and presents other qualities which are injurious in further working.

To obviate this imperfect defecation, the device has been adopted of not drawing off to the works the juice of the diffuser which has just been mashed, but passing it into the next two diffusers. The result is that tolerably perfect defecation is secured, but at the cost of having two diffusers separate from the working battery, and there is a constant danger of impurities and fermentation germs accumulating in the first juice, multiplying in the chips, and becoming spread through the whole of the juice in the battery. Those who have worked through a season's operations with cane sugar know how much more quickly cane juice deteriorates as compared with beet juice; as there is an absence of carbonic acid, all excess of lime has to be carefully avoided, the boiling up, skimming, and running off must be continually attended to, all of them processes which are very difficult where a diffusion battery is used. From what has been said the conclusion is evident that defecation in the battery has yet to be practically tried for some time before the process can be considered as preferable to that hitherto in use, and at the same time profitable.

I will only just mention the difficulty connected with emptying out the troublesome diffusion chips, conveying them to the mill where they are deprived of water by double pressing, and burning them in specially constructed furnaces, because it may be assumed that these difficulties will be overcome by intelligent and energetic management, but a good deal of additional manual labour is said to be required for this, which is not always openly admitted in the reports of the working. For instance, I learn from a friend in Soerabaya, that the much vaunted mechanical transport by means of endless bands, by which the chips from the diffusers are conveyed to the mill, require in a plant which has been set up in Java the constant assistance of twelve men, so that one may well ask whether these twelve men would not be able to do the work without the bands. A similar state of things was mentioned to me just lately by a manufacturer of this place, who had seen a French arrangement of the kind in either Martinique or Guadeloupe. The economy in wages is therefore rather a wish than

a fact in the case of the diffusion process, and if those who have adopted it are singing its praises, this is to be ascribed in many cases to the fact of the new system not being worse than the old one, or simply to the fact of their having adopted it. To make an end of my remarks about diffusion, I would once more give prominence to the fact, that the increase in the juice extraction, accompanied, as it unavoidably is, by very considerable dilution, results in the production of such a quantity of juice *plus* water as cannot as a rule be dealt with by the evaporating apparatus hitherto in use in existing factories, so that an addition to the efficiency of the entire evaporation plant must needs go hand in hand with the erection of a diffusion plant, and with all this the mills cannot be dispensed with.

On the other hand let us consider a good modern mill plant, *i.e.*, with double pressure, such as are now met with in factories which are doing pretty well.

From 300 to 400 tons of cane are worked up per twenty-four hours, three mills being used, two in front and one behind.

The bagasse coming from the first crushing is saturated with hot water immediately on issuing from the rollers, and then passes through the third mill. By this arrangement about 82% (by weight) of the normal juice in the cane is obtained, which is diluted, and of course increased in quantity, by 15 to 20% of water imbibed by the bagasse. Without maceration, 75% of normal juice is obtained by double crushing. The cane contains a total quantity of 90% (by weight) of normal juice of 1·06 to 1·08 specific gravity, and 10% of fibre. The question whether maceration is used or not depends first of all on the capability of the evaporating apparatus, but then we have to consider whether the reduction in the quality of the juice, caused by saturating the bagasse with hot water and the increased pressure, and also the dilution of the juice, necessitating an equivalent greater consumption of fuel, do not outweigh the advantage obtained which after al consists only in an ecomony in the very cheap raw material.

Thus with such simple apparatus as a cane mill, and one to which the natives are so thoroughly accustomed, 82% out of the 90% of juice in the cane can be obtained, and this with far less dilution than by diffusion. When we consider, that even diffusion cannot extract all the sugar, it seems clear that the advantage of diffusion over good mill work is inappreciably small where the raw material is cheap and

abundant. The figures which have been quoted may be subject to some alteration according to circumstances, but from what has been said, it may be seen, that where cane is cheap good mill work can compete successfully with diffusion, and that there is no possible chance of the latter extending so rapidly in the colonies as it has done in the case of the beet sugar manufacture.

Correspondence.

THE PROPOSED GERMAN SUGAR LEGISLATION.

To the Editor of "The Sugar Cane."

Sir,—My attention has been directed by several friends in the cane-sugar trade to certain very peculiar utterances that have escaped some of the leaders in the excited contest which is going on in Germany at present for and against the bounties.

As these phrases are extremely characteristic of the manner of fighting here, it may not perhaps be without interest to your readers to have just a couple from a collection of these purely rhetorical performances duly held up to inspection.

(1) The deputation of the "Union of the Beet-Sugar Industry of the German Empire" having been refused a hearing by the Chancellor of the Empire, was received the other day by the Chancellor of the Exchequer. Herr V. Maltzahn, after hearing the speech of the leader of the deputation, asked the German sugar industry (among other things) for *a guarantee that the German engineering firms do not support foreign (beet and cane) sugar industries by supplying them with modern plant and machinery.*

I do not know if the German engineers are very well pleased with the above invitation to build, as it were, a great wall of China around their works and so limit their sphere of activity. I must be allowed to be a little sceptical as regards the rationality of such a proposal on the part of his Excellency, in the present times of international commerce and intercourse, leaving aside the doctrines of either John Stuart Mill or of a Protectionist of the fair-trade school. Anyhow, I am sure that the non-German Sugar Industry would not be likely to die, even though certain Continental engineering shops were closed,

and further—that English, French, American, &c., engineers and sugar-planters will be heartily amused at such a two-edged policy.

(2) Another still more striking absurdity is to be found in a petition of the Director of the Association above mentioned. The pamphlet is addressed to the Chancellor of the Empire, and contains the following very remarkable passage:—

. . . *That which we (the German sugar manufacturers) obtained by great efforts, by hard work, and large outlay, our competitors are now profiting by, without trouble or pains. In all these countries (Australia, South America, Canada (!), the West and East Indies, &c.,) agriculturists and manufacturers are putting off childish ways. They are doing so by means of those implements which were obtained or derived from us. They are increasing their yield, reducing the cost of production, and are pressing us hard with a competition which is being crowned with victory."* . . .

And so the petition runs on in the same style.

No one is ignorant of the high intelligence of the German sugar manufacturers, chemists, and engineers, and I think I myself, in particular, am free from the reproach of not acknowledging the invaluable services which they have rendered to the sugar industry in general.

But the above remarks sound pretty much as if Germany had a monopoly of intelligence. I therefore think it may be well now and then to remind such people as those who drew up the petition that for a few not altogether unimportant inventions we are indebted to other people than Germans. On this account it might be advisable to be a little more moderate in future, and not to boast in this ridiculous fashion. I would ask, first of all, in what manner and in what country did the cultivation of the sugar-cane profit by German inventions? Does Mr. Kieschke perchance consider the steam-plough a German invention?

Secondly. I should like to know—as regards manufacturing machinery and apparatus—

Did Mr. Riedinger invent his hydraulic elevator in Germany?

Was not Mr. J. Robert—the father of the diffusion process, which really made the whole beet industry what it is—an Austrian?

Who first arranged in Germany the Jellinek double-carbonation-process?

Was Mr. N. Rillieux, the first inventor and constructor of a practical multiple-effect, a Frenchman ?

Did Mr. Howard construct his vacuum pan for the German sugar works ?

Did the Germans invent the steam engines they are now using ?

I do not like to take up any more of your space by asking further questions. I think the above is enough to show that other nations would be equally justified in maintaining that the German sugar industry "put off childish ways" by means of apparatus taken from them. At the same time what has been said shows that all improvements in the modern technical working of the sugar industry are on the whole of international origin, and that it is to very little purpose to talk of "national inventions" in these modern times.

Everyone knows that the style of the language in the petition, &c., to which I take exception, is to be ascribed to the new German sugar bill intended to abolish the "Premiums." I am sure there are plenty, both Germans and non-Germans, who sympathise at present with the German sugar industry, the prosperity of which will certainly be reduced if the bill becomes law. These are awkward times for such a step while France and the United States are giving tremendous bounties. However, some one has to be the first to start.

But this should be no reason for those who are defending the interests of the industry to forget some of those special virtues for which Tacitus once praised their forefathers.

One may be a free-trader, a protectionist, or a fair-trader, but in any case the weapons for defending one's opinion should be bright and unsullied, the mode of conducting the contest fair and straightforward.

I am, Sir,

Yours respectfully,

GEO. STADE.

Charlottenburg 2 (Berlin),

15th December, 1890.

BARBADOS AND THE Mc.KINLEY TARIFF.

To the Editor of "The Sugar Cane."

Sir,—The Mc.Kinley Tariff, so far as sugar is concerned, is an encouraging feature for the cane sugar industry. The reception it has met with generally by the American people is a clear indication that a general high protective tariff is, in the near future, an impossibility. The consumers are becoming aware of the fact that high protective duties simply make the few rich at the expense of the many. The population of the West, the producers of food stuffs, are unprotected, for they export and do not import the necessaries of life. They are beginning to see that they are paying very high prices for all manufactured goods, and that they do this simply for the benefit of the manufacturer; that he is made rich at their expense. When this opinion becomes more pronounced the change from protection to free trade will, so to speak. be the change of a moment. The agriculturists too of the South are subjected to the same disadvantages as the inhabitants of the West, but, as their owu industries are protected, they are less inclined to adopt the principles of free trade. When their disinclination disappears we shall then see a further reduction in the sugar duties. The cane sugar producers must not however be too sanguine as to the effect of the Mc.Kinley tariff on their products. Molasses for instance is at a disadvantage by reason of the alteration of the duties. The low sugars, going in duty free, will interfere with it. Happily the export of molasses from Barbados to the United States is small. This year the shipments to the States were 5330 hhds. 301 tierces and 287 barrels, whereas to the British Provinces the shipments were 41,821½ hhds. 3901 tierces and 3530½ barrels. It must not be forgotten, however, that probably a much larger shipment of the Cuba crop of molasses will now be shipped to the British Provinces, seeing that the United States market will be unfavourable by reason of the new American tariff. If so the demand for British West Indian molasses may fall off. Again the reciprocity clause in the Mc.Kinley tariff may frustrate the benefit which otherwise would result from it. Unhappily the West Indian colonies are not permitted by the mother country to make commercial reciprocal arrangements with foreign countries. In 1885-6 the legislature of Barbados passed a Bill allowing all American products

to be imported into the island free of duty, the American Government admitting their sugars free of duty. The Bill was disallowed by the home Government, as the American Government made it a *sine qua non* that the traffic both ways should be carried by American and British ships only. I think that all connected with the island of Barbados will bear me out that had the bill been confirmed the island of Barbados, at this moment, would have been in a very flourishing condition. Unfortunately we are the offspring of an unnatural parent and alas we are too weak to assert our independence. Had too the Bill been confirmed the labourers would have had every article of food duty free. I do not mention the possible results of the Mc.Kinley tariff to discourage the producers of cane sugar. It is useless to close our eyes, like the ostrich, to the dangers that lie before us. Such dangers when seen, should urge us to increased endeavours to overcome them. Our safeguards are to be found in improved cultivation, and in improved machinery. Both of these are now largely availed of in Barbados and elsewhere. In Barbados, an island as large only as the Isle of Wight, the crop shipped this year was 85,311 hhds. of sugar and 50,937 puncheons of molasses. The consumption of native sugar in the island is from 2000 to 3000 hhds. This must be added to the shipments to get to the total of the production. Besides this large production of sugar, the island produces crops of yams, sweet potatoes, corn, &c. Truly a production that does credit to the agriculturists of Barbados.

Your obedient servant,

W. H. JONES.

2, Vermont Road, Upper Norwood,
17th December, 1890.

P.S.—I may mention that the vessels now engaged in the trade between America and Barbados are probably $\frac{18}{20}$ths American and British vessels. Possibly I might state it as $\frac{48}{50}$ths, but I deem it best to avoid exaggeration. The Bill too was a thorough free trade Bill. It threw the port open, duty free, to all products similar to those produced in America, no matter from what country they came. It was cruel on the part of the home Government to refuse to confirm it. It was a free trade government too.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. THOMPSON, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; and 323, High Holborn, London.

ENGLISH.

APPLICATIONS.

16251. H. H. BADAMS, Birmingham. *Improvements in filter presses.* 13th October, 1890.

16326. T. SLAITER, London. *Improvements in multiple evaporating apparatus.* 14th October, 1890.

16461. F. H. FLOTTMANN, London. *Improvements in vacuum pans.* (Complete specification.) 16th October, 1890.

16552. F. W. SCOTT, junior, London. *Improvements relating to vacuum and evaporating pans.* 17th October, 1890.

16528. T. E. WILSON, London. *Improvements in apparatus for evaporating, distilling, or concentrating liquids.* 17th October, 1890.

16616. R. MORRIS, London. *An improvement in feeding apparatus for filters.* 18th October, 1890.

17232. H. H. LEIGH, London. (Communicated by F. T. Romiguières, France). *Improvements in refining sugar.* 28th October, 1890.

17237. P. CALLIBURCES, London. *An improved and completed system of apparatuses for evaporation and distillation.* (Date applied for under Patents Act, 1883, Section 103.) 15th July, 1890, being date of application in France. (Complete Specification.) 28th October, 1890.

17514. J. E. WEYMAN and J. A. DRAKE, Sheffield. *Improvements in filter presses and appliances connected therewith.* 1st November, 1890.

17520. C. E. HALL, Sheffield. *Improvements in pulverising and crushing mills and amalgamators.* 1st November, 1890.

IMPORTS AND EXPORTS (UNITED KINGDOM) OF RAW AND REFINED SUGARS.

JANUARY 1ST TO NOVEMBER 30TH.

Board of Trade Returns.

IMPORTS.

RAW SUGARS.	QUANTITIES.		VALUE.	
	1889.	1890.	1889.	1890.
	Cwts.	Cwts.	£	£
Germany	5,370,925	6,166,717	4,228,703	3,767,187
Holland..................	406,416	410,798	336,984	239,558
Belgium	1,046,620	1,151,057	695,261	690,143
France	298,339	1,217,330	218,667	763,985
British West Indies & Guiana	1,697,798	1,239,757	1,613,343	939,384
British East Indies	1,701,857	693,325	1,157,411	357,171
China and Hong Kong	45,874	....	35,616	....
Mauritius	294,282	245,525	287,031	155,368
Spanish West India Islands	49,535	42,130	44,230	31,597
Brazil	708,038	349,945	505,681	212,425
Java	2,278,212	1,238,241	1,960,312	877,036
Philippine Islands	1,023,249	423,053	605,759	225,609
Peru	644,656	592,820	525,028	402,881
Other Countries	646,111	352,733	566,927	251,050
Total of Raw Sugars ..	16,211,912	14,123,431	12,780,953	8,913,394
Molasses	378,082	549,741	139,846	178,434
Total Sugar and Molasses	....	....	20,925,228	16,348,139
REFINED SUGARS.				
Germany	3,684,048	4,377,954	3,732,487	3,542,789
Holland..................	1,228,783	1,670,684	1,243,997	1,391,848
Belgium	214,726	164,306	226,650	146,097
France	2,196,936	2,407,691	2,158,679	1,953,489
United States	10,040	259,815	9,759	217,300
Other Countries	631,500	5,715	632,857	4,788
Total of Refined	7,966,033	8,886,165	8,004,429	7,256,311

EXPORTS.—REFINED SUGARS.

	Cwts.	Cwts.	£	£
Sweden and Norway	80,868	59,022	70,942	44,098
Denmark	128,534	119,281	97,249	73,775
Holland	91,845	84,055	74,532	59,830
Belgium	25,935	26,722	19,455	18,638
France	6,282	4,777	4,935	3,119
Portugal, Azores, & Madeira	84,604	73,771	66,675	49,855
Italy	98,034	68,755	82,165	47,039
Other Countries	155,040	210,103	135,161	162,798
Total of Exports......	671,142	646,486	551,114	459,152

IMPORTS OF FOREIGN REFINED SUGAR.

The British Sugar Refiners' Committee furnish us with the following figures, giving the imports of foreign refined sugar for the month of November, 1890, compared with the corresponding month of the two preceding years, and the average monthly imports for the year compared with those of 1887, 1888, and 1889, distinguishing the quantities of "Lumps and Loaves" from "other sorts," and giving the separate imports from each country:—

Countries from which Sugar has been imported.	"Lumps and Loaves."							"Other Sorts." Including Crushed Loaf, Granulated, Crystallized, &c.							Total.						
	Monthly Average.				Nov.	Nov.	Nov.	Monthly Average.				Nov.	Nov.	Nov.	Monthly Average.				Nov.	Nov.	Nov.
	1887	1888	1889	1890	1888	1889	1890	1887	1888	1889	1890	1888	1889	1890	1887	1888	1889	1890	1888	1889	1890
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France	1363	1686	2373	2788	2121	4582	1842	5099	4855	8596	8154	17543	24214	10133	6462	6541	10969	10942	19664	28796	11975
Holland	3780	3267	2294	2938	3224	2852	2596	2483	2675	3354	4655	2986	4930	4987	6263	5942	5648	7593	6210	7782	7583
Germany & Austria	1347	1510	2573	2453	1922	2619	2496	10463	11729	13844	17446	11952	18927	23810	11810	13239	16417	19899	13874	21546	26306
Belgium	592	622	827	394	507	738	619	308	227	225	352	123	290	969	900	849	1052	746	630	1028	1588
United States	454	8	..	102	..	..	..	2804	157	42	1078	7	1	8	3258	165	42	1180	7	1	8
Russia	3	..	23	..	..	3	..	452	1959	2015	..	292	44	..	455	1959	2038	..	292	47	..
Other Countries	..	1	239	..	..	..	..	15	2	355	26	10	..	70	15	3	594	26	10	..	70
Total	7539	7094	8329	8675	7774	10794	7553	21624	21604	28431	31711	32913	48406	39977	29163	28698	36760	40386	40687	59200	47530

SUGAR STATISTICS—GREAT BRITAIN.

FOR THE FOUR PRINCIPAL PORTS.

TO DECEMBER 13TH, 1890 AND 1889. IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

	STOCKS.		DELIVERIES.		IMPORTS.	
	1890.	1889.	1890.	1889.	1890.	1889.
London	26	47	268	299	247	327
Liverpool ..	49	85	263	274	228	285
Clyde......	35	41	203	226	208	248
Bristol	3	3	61	54	64	50
Total ..	113	176	795	853	747	910

The above figures do not represent accurately, or to the full extent, the position and movements of sugar in the United Kingdom, as Hull, Leith, &c., are not included, there being no published returns for these ports.

SUGAR STATISTICS—UNITED STATES.

(From Willett & Gray's Report.)

FOR THE FOUR PRINCIPAL PORTS. IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND. FOR NOVEMBER, 1890 AND 1889.

	STOCKS. December 1st.		DELIVERIES. In Nov.		IMPORTS. In Nov.	
	1890.	1889.	1890.	1889.	1890.	1889.
New York	18	11	34	48	39	31
Boston	3	1	9	2	11	1
Philadelphia....	$\frac{3}{4}$	..	21	20	21	20
Baltimore	..	..	..	..	..	..
Total......	$21\frac{3}{4}$	12	64	70	71	52
Total for the year..........			1101	971	1112	951

NEW YORK PRICES FOR SUGAR.

From Willett & Gray's Report, December 18th, 1890.

FAIR REFINING.	96o/o CENTFS.	GRANULATED.	STAND. A.	STOCK IN FOUR PORTS.
Dec. 18, 1890.—4 9-16c.	$5\frac{1}{4}$c.	6c.	$5\frac{3}{4}$c.	Jan. 1, 1890— 11,169 tons.
Dec. 19, 1889.—$5\frac{1}{4}$c.	6c.	$6\frac{3}{4}$c.	$6\frac{1}{2}$c.	Jan. 1, 1889— 32,254 tons.
Dec. 20, 1888.—$5\frac{1}{4}$c.	$6\frac{1}{4}$c.	$7\frac{1}{4}$c.	$6\frac{7}{8}$c.	Jan. 1, 1888— 47,798 tons.
Dec. 22, 1887.—$5\frac{5}{8}$c.	5 15-16c.	$6\frac{7}{8}$c.	$6\frac{1}{2}$-9-16c.	Jan. 1, 1887—102,279 tons.
Dec. 23, 1886.—$4\frac{5}{8}$c.	$5\frac{1}{8}$c.	5 11-16-$\frac{3}{4}$c	$5\frac{3}{8}$c.	Jan. 1, 1886— 57,328 tons.
Dec. 24, 1885.—$5\frac{1}{2}$c.	$5\frac{1}{4}$c.	$6\frac{3}{4}$c.	$6\frac{1}{4}$c.	Jan. 1, 1885— 89,186 tons.
Dec. 18, 1884.—$4\frac{3}{4}$c.	5 5-16c.	$5\frac{7}{8}$c.	$5\frac{1}{2}$c.	Jan. 1, 1884— 60,900 tons.
Dec. 20, 1883.—6 3-16c.	7 1-16c.	$7\frac{7}{8}$c.	$7\frac{3}{8}$c.	Jan. 1, 1883— 50,297 tons.
Dec. 21, 1882.—7c.	7 11-16c.	$8\frac{3}{4}$c.	$8\frac{1}{4}$c.	Jan. 1, 1882— 43,927 tons.
Dec. 22, 1881.—$7\frac{3}{8}$c.	8 1-16c.	9 3-16-$\frac{1}{4}$c.	$8\frac{3}{4}$c.	Jan. 1, 1881— 66,999 tons.

STOCKS OF SUGAR IN THE CHIEF MARKETS OF EUROPE ON THE 30TH NOVEMBER, FOR THREE YEARS, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal entrepôts.	TOTAL 1890.	TOTAL 1889.	TOTAL 1888.
112	305	184	220	26	17	864	1001	714

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING 30TH NOVEMBER, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal entrepôts.	TOTAL 1890.	TOTAL 1889.	TOTAL 1888.
1320	502	509	309	52	380	3072	2833	2732

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE PRESENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1890-91. Tons.	1889-90. Tons.	1888-89. Tons.	1887-88. Tons.
German Empire	1,310,000	1,264,607	990,604	959,166
France	770,000	753,078	466,767	392,824
Austria-Hungary	760,000	787,989	523,242	428,616
Russia	530,000	465,000	526,387	441,342
Belgium	200,000	221,480	145,804	140,742
Holland	50,000	55,813	46,040	39,280
Other Countries	75,000	80,000	87,000	79,980
Total	3,695,000	3,627,967	2,785,844	2,481,950

Basing his estimate on official figures Mr. Licht now gives 1,310,000 tons as the probable production for Germany during the current campaign. This is 60,000 tons more than his estimate of last month. The other figures of last month he leaves unaltered for the present.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

Business in all kinds of cane sugar has been somewhat limited during the month, partly owing to the near approach of the holidays, partly to the restriction of speculation by reports of larger crops in Cuba, &c., and to the maintenance of the high estimates of the beet crop. Sales have been made in Jaggery and Manila for spring delivery. The tendency, now become so marked in nearly all quarters, to buy for future delivery very far ahead, plays into the hands of speculators and materially assists their operations. There seems to be no reason, apart from the smallness of stocks here and in America, why buyers and consumers should provide themselves so long beforehand; supplies promise to be fully equal to the demand, and the effect of the McKinley tariff is as yet far too uncertain to be taken into account. There was a fair demand for low East India and for West India Crystals. Refined quiet, especially foreign kinds. English sorts advanced 3d. during the month.

Prices of beet rose to 12/6 but left off with a quiet market at 12/4½. The November imports of beet sugar were greater by 5,000 tons than in the same month of the previous year.

Owing to the holidays falling at the end of the week we have not received the usual returns, but the statistical position is unchanged, viz., diminished receipts and deliveries as compared with last year. It is probable that the new year may see a considerable renewal of activity.

Present quotations for the standard qualities, as under, are :—

FLOATING.			Last Month.
Porto Rico, fair to good Refining	12/9 to 13/9	against	12/9 to 14/0.
Cuba Centrifugals, 97°/ₒ polarization	14/3	,,	14/6
Cuba, fair to good Refining	12/9 to 13/3	,,	13/- to 13/6.
Java, No. 14 to 15 D.S...	14/6 to 15/-	,,	14/9 to 15/-.
British West India, fair brown	12/0	,,	12/3
Bahia, low to middling brown	11/3 to 11/9	,,	11/3 to 11/9.
,, Nos. 8 to 9	12/- to 12/3	,,	12/0 to 12/3.
Pernams, regular to superior Americanos.	11/6 to 12/9	,,	11/6 to 12/9.

LANDED.			Last Month.
Madras Cane Jaggery..	10/3	against	10/3
Manila Cebu and Ilo Ilo	10/-	,,	10/-
Paris Loaves, f.o.b...	16/9	against	16/9
Russian Crystals, No. 3, c.i.f.	14/10½	,,	
Titlers	18/-	,,	17/9
Tate's Cubes..	19/3	,,	19/-
Beet, German and Austrian, 88%, f.o.b. ..	12/4½	,,	12/3

THE

SUGAR CANE.

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☞ The writers alone are responsible for their statements.

All communications to be addressed and all cheques, &c., made payable to "Edward Sutton, Editor of The Sugar Cane, Manchester," which address is sufficient.

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We reprint, on page 72, a letter written to the *Louisiana Planter*, under the heading of "Economy Essentials," which would seem to indicate that the bounty under the new tariff arrangements is not after all calculated to produce the immediate very large increase in the production of American cane sugar which has been so confidently predicted. In this connection we copy from the same journal the following remarks on the imports of sugar into the United States, and call particular attention to the passage which we have printed in italics:—

"The total imports of sugar into the United States for the ten months ending October 31st, were 1,240,829 short tons, against 1,099,641 short tons during the same period in 1889, showing an increase of 141,188 tons for 1890, or about 13 per cent. If such an increase annually be maintained the consumption of the United States will reach 3,000,000 tons of sugar before the year 1900.

Of the sugars imported this year 255,905 tons were beet sugar, as against but 91,776 tons of beet sugar during this period in 1889.

These sugars show then that our entire increase of consumption and some 23,000 tons over, have been made up by increased imports of beet sugars. *Although the United States lies near the tropical sugar countries, they have fallen off in their current supplies to this country, and their deficient supply and our own increase of consumption has had to be supplied by the European beet.*

All this seems somewhat contrary to nature, and it does seem that the United States should equal or surpass Europe in building up a

domestic sugar industry when the evidence is indisputable, as now, that we shall need the sugar and have every natural advantage for its economical production."

We invite the attention of our readers to a letter received through Mr. Nevile Lubbock from Mr. Frederic J. Scard, the well-known and experienced chemist to the Colonial Estates Company. Mr. Scard contests the accuracy of the results arrived at by Mr. J. N. S. Williams, of Honolulu, in the letter which appeared in our December issue; and it is quite evident that we must still withhold our judgment as to the adaptability of diffusion to many of the British Colonies

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We note that Mr. C. Czarnikow, of London, Glasgow, and Liverpool, is extending his business connections by establishing in New York a Brokerage and Agency Business in Sugar, &c., under the firm of Czarnikow, Macdougall & Co., Limited; Mr. Czarnikow being managing director. The business in New York will be managed by Messrs. George Rogers Macdougall, and Joseph Lentilhon, both gentlemen having had considerable local experience.

While regarding the mission of the Hon. G. E. Foster, the, so to speak, accredited commercial representative of the Dominion of Canada with the greatest interest, it is impossible not to admit the sound reasoning of the *Barbados Globe*, which points out that while there is a Canadian point of view—the main strength of which lies in the natural predilection of one English Colony for business and social dealings with another English Colony—there are, on the other hand, the commercial, planters', and consumers' points; and we fear that Canada, with her comparatively small population and productive ability, has no chance in the race with the great and populous United States, and that neither Barbados, Jamaica, nor the other West Indian Islands can afford to give up their North American market in favour of what the Dominion has to offer.

The January number of the *Kew Bulletin* contains an interesting recapitulation of what has been done and said about *Seedling Canes*, nearly the whole of which has, however, already appeared in our

columns. The latter part, containing the closing remarks of Mr. W. T. Thiselton Dyer, and a letter received by him from Mauritius, is very interesting and conclusive, and we are glad to reproduce it. Mr. Dyer says:—

To sum up. Though the work done in Java undoubtedly anticipated that done in the West Indies by Messrs. Harrison and Bovell, it attracted but little general attention. The discovery of these latter gentlemen has been termed "accidental." Even if true, that is no demerit. Most discoveries in some sort are accidental. They often lie, so to speak, under our eyes, and only reveal their significance to those who are ready to appreciate it. This Messrs. Harrison and Bovell did, and the greatest credit is due to them for the fact. All that Kew has done in the matter was to put it on record and give it a scientific verification. For my part, I have no doubt, looking at the whole history of the improvement of cultivated plants, that the discovery, for so I think it, of Messrs. Harrison and Bovell has been the starting point of a new era in the cultivation of the sugar-cane, and with time and patience I do not see why even the aspirations of Mr. Neville Lubbock should not be realised. But it will require both.

At the moment of sending this paper to press I have received the following important communication from the Director of Forests and Botanical Gardens, Mauritius. It shows that the advice given from Kew in 1886, as to the possibility of effecting something for the improvement of the sugar-cane by taking advantage of "bud variation," though based upon theoretical considerations, was fully justified. I do not, however, pit one method against the other. I simply point out that the cultivator in quest of new varieties has, so to speak, two strings to his bow.

W. T. THISELTON DYER.

ROYAL BOTANICAL GARDENS, MAURITIUS, TO ROYAL GARDENS, KEW.

The Gardens, Curepipe, Mauritius,
9th December, 1890.

Dear Sir,— * * * * Raising canes from seed to get improved varieties will be a long and tedious affair, and there will be many disappointments before a really good hardy sugar-yielding variety will be obtained. I think it probable that more and better results will be obtained by good cultivation and by new varieties from

bud sports. Of these last we have eight or nine in Mauritius alone; some of them are very fine canes, and they are extensively planted. Most of them are hardier than their parents and yield more sugar. They are mostly obtained from new canes recently introduced. The sudden change of climate, soil, and other circumstances cause them to be thrown off. More of them might be obtained if the planters were more observing than they are, and closely followed the cane cutters when cutting the canes. Thus they would range all their fields over, perhaps, areas amounting to 1,500 acres, matching each cane as it is seen cut. As things are, a new variety is only observed should it chance to spring up in an outside row.—Yours, &c.,

(Signed) JOHN HORNE.

W. T. Thiselton Dyer, Esq., C.M.G., F.R.S.

In our last issue we alluded to the crisis through which the Sugar Trust was passing, and the sharp fall in Certificates. This is now over, the Trust has been practically reconstituted, and Certificates have risen from the lowest point touched (50½ in December) to 82, the closing price on the 14th January. Messrs. Willett & Gray report as follows:—

"SUGAR TRUST.—Under direction of the Courts, this organization, which has claimed the attention of the public so largely since its formation in November, 1887, has ceased to exist, and with its extinction all the corporations of which it was composed have also become extinct, by sale and transfer of their properties, and in its place is 'The American Sugar Refining Company,' incorporated in the State of New Jersey, with capital of $25,000,000 Preferred Stock, bearing 7% cumulative interest, but having no further claim to division of profits, and $25,000,000 of Common Stock entitled to such dividends as may be declared from time to time. Also, $10,000,000 of 6% bonds.

"The American Sugar Refining Company have thirteen factories in running order, located in the States of New York, New Jersey, Massachusetts, Louisiana, and Missouri, with a capacity of say 30,000 barrels per day, which is a melting capacity of 1,275,000 tons per annum, of which they used 987,570 tons in 1888, and 863,305 tons in 1889 (we will give figures for 1890 soon). Free sugar will enable them probably to use nearly all their capacity this year. At a moderate calculation 3-16c. per lb. profit in refining will give 7% net income on all the stock and bonds. The latter are probably only intended for temporary use in loans, when it is desirable to carry large

stocks of sugar, and the Company starts with over $7,000,000 cash capital, which is abundant for their nominal business. The refining business of the United States will be carried on this year by the following companies, all of which are in active competition with each other:—The American Sugar Refining Company, mentioned above; The Franklin Sugar Refining Company; The Sprekels Sugar Refining Company; Messrs. E. C. Knight & Co.'s Keystone Sugar Refinery; and the Delaware Sugar House, of Philadelphia; The Baltimore Sugar Refining Company, of Baltimore; The Revere Sugar Refinery, of Boston; The American Sugar Refinery and the California Sugar Refinery of San Francisco. The capacity of the whole is about 45,000 barrels, or 1,900,000 tons per annum."

The directors of the new company are: H. O. Havemeyer, T. A. Havemeyer, F. O. Matthiessen, J. E. Searles, junr., William Dick, J. R. Thomas, and George C. Magoun. H. O. Havemeyer is the President, and Mr. Searles is Secretary.

We take the following from a letter addressed to the *European Mail* by an esteemed correspondent, Mr. W. H. Jones:—

"So far as sugar is concerned, the M'Kinley Tariff Bill does not come into operation before April 1st, 1891. All sugar up to Dutch standard No. 16 is to be admitted free, and a bounty will be given on all home-grown sugar, whether made from cane, beetroot, sorghum, or maple sap. The effect of the tariff will probably cause the English ports to be the best markets for cane sugar, for such large supplies of it will be sent to the United States to benefit by the abolition of the duty that the supply in England may be insufficient. As, however, there is a duty on the importation of beet sugar into America, we may have a larger supply of that quality of sugar in our markets, and hence not get the full benefit of the cane shipments to America. There can, however, be little doubt that the large increased consumption of sugar in America, by reason of the abolition of the duty up to 16 Dutch standard, will cause the markets of the world to be firm, if not considerably in advance of present prices."

The New York *Merchants' Review* has the following remarks on the prospects of the home sugar production, which seem very well to the point as regards the bounty question:—

The Chicago *Grocers' Criterion* says:—"It begins to look as though the United States would soon be able to manufacture all the sugar

needed for home consumption, and that the foreign article can be altogether dispensed with. A year or two ago we ventured to make this prediction, and the *Merchants' Review* of New York affirmed that our proposition was preposterous. We are glad to see it coming around at this late day to an appreciation of the possibilities of beet-sugar making in the United States.

Our esteemed contemporary is mistaken. We did not say the notion was "preposterous," but that it was not likely to be realized for many years. Since then a bounty has been granted domestic sugar growers, which alters the situation materially. We see no reason why, if the bounty is continued for, say, ten years, the United States should not within that period produce enough sugar for domestic consumption. No journal will hail such an event with more satisfaction than the *Merchants' Review*. At the same time we cannot overlook the fact that the bounty sooner or later must be discontinued. The United States is the wealthiest country on the face of the earth, but it could not persist in the bounty policy without ultimate bankruptcy. Sugar growers alone will not be allowed to enjoy the handsome gratuity of two cents. upon every pound of their product; other producers will want a similar privilege, and then the whole system will soon go by the board. Now the question is, can the United States maintain a domestic sugar industry, sufficient to supply the home consumption, when the bounty is withdrawn? If it cannot it is useless to attempt to build it up by heavy drafts on the public treasury."

The Commission of the Reichstag to which, as we mentioned last month, the consideration of the proposed new German sugar legislation was committed, has held several sittings, and its work is as yet incomplete. Considerable difference of opinion has arisen. Up to now the results arrived at are: The fixed rates of premiums proposed by the Government draft to last for three years have been rejected, and the proposal of Court Hatzfeldt to fix the rates at M. 1·50 for raw sugars, M. 2·25 for first quality, and M. 1·90 for second quality refined, for a period to remain as yet indefinite, has been adopted by 16 against 11 votes. The tax on consumption proposed by the Government was reduced from M. 22 to M. 16.

What may be the ultimate result of the final debate in the Reichstag

cannot be predicted with any confidence. One thing only is certain, the duty on the raw material (*materialsteuer*) is abolished, and it is curious to note how almost unanimous is the rejection of this mode of taxation, which undoubtedly has been the means of raising the German sugar industry to its present prosperity. It would appear that the general feeling is that the time has come when sugar manufacturers should cease to enjoy their exceptionally favoured position.

At the moment of going to press, a somewhat hazy telegram informs us that the whole of the Government proposals have been rejected by the Commission.

It is reported that a new project for sugar legislation in France will be shortly brought forward, which is to be of a permanent character, and while it places a limit to the sacrifices made by the Treasury will satisfy the just demands of the sugar industry and the agriculturists. This will certainly be a novelty, and in view of the remarkable changes which almost every year has seen in the French sugar duties, and the great difficulty of reconciling the opposing interests, a man must be of a very optimist tendency to consider the attainment of this permanent golden mean as a near probability.

A new Customs regulation has been adopted in Belgium, by which several chemical products, not hitherto classified in the *tarif des douanes*, and which can be transformed into saccharine by an elementary process, are now assimilated to saccharine, and will have to pay a duty of 140 fr. per kilo.=about £2 10s. 6d. per lb. We learn from a Consular Report that the import of saccharine into Venice and Ancona increased in 1889 in consequence of the heavy duty imposed for the protection of the Italian refiners.

In Spain the four beet sugar factories, which were not long ago established near Granada, are working satisfactorily and increasing their output. The aim is rather to grow a large quantity of beets, paying comparatively little attention to their saccharine content.

INDIA.

Sugar Cultivation.

In our October issue we gave, under the above heading, a portion of the letter of Mr. Francis M. G. Gill (formerly chemist in the Aska Sugar Works and now manager of Messrs. Perry and Company's factory, at Nellikupam, both in Madras) to the Madras government. We have thought it advisable to find room for the remaining portion, which will form a valuable basis for reference in the consideration, which cannot much longer be deferred, of the whole question of sugar growing and refining in India, and the position of the Indian government towards what ought to be a staple industry of the country. Mr. Gill writes:—

"I must first premise that I am an analytical chemist, and was employed as such for three years in one of the largest sugar refineries in London, before I came out to India in December, 1875, as chemist and assistant in the Aska Sugar Works, and that since the commencement of 1879 I have been in charge of Messrs. Parry's factory at Nellikupam, and that at both factories I have had a laboratory thoroughly well appointed for sugar analysis. So circumstanced, I have made a study to some extent of the nature of the several varieties of the sugar cane I have come across, and of their several sugar-yielding capacities; and as a result I can indicate a cause of the inferiority of the native produce of the cane, which is not usually considered, while it is by far the greater cause. This cause is inferiority of the cane worked, owing either to: 1st. Innate inferiority of the cane. 2nd. Unseasonable working of the cane. With my limited leisure for analytical work, I have not been able to differentiate between the two possible reasons, but the following analysis will show to what an extent either reason or both of them operate in the outturn of the inferior jaggery, so generally, and I may add, loosely animadverted upon:—

"1st. What appears to me to be the true Chinese sugar cane largely grown in parts of Bengal I believe, and is largely grown in the Kallakurchi taluk of the south Arcot district and is grown to some extent in Tanjore. As grown at Kallakurchi it is, for plant cane as distinguished from ratoon cane, from 6 to 8 feet long and from ½ to 1 inch diameter at butt, with very little taper to tip. Knots 6in. to 8in. apart; rind, mellow yellow, or yellowish green,

with white silicious bloom, and with thick white silicious incrustation at knots. The cane is very heavy, dense, and difficult to crush. The juice is very thick, and yields necessarily a large quantity of jaggery.

"From so fibrous a cane, good milling would take out only 110 gallons juice per ton (=52·7 per cent. juice on cane) and thence the jaggery, or simply concreted juice, with retention of 8 per cent. water would be—

	lb.	lb.	lb.
Per ton cane	232·4 ..	232·0 ..	231·3
Taking that an acre of land grows 20 ton cane, Jaggery per acre to be obtained is.	Tons. 2·07 ..	Tons. 2·07 ..	Tons. 2·06

"So far so good for local bazaar sales. For direct consumption among the natives of the country, jaggery is jaggery, irrespective of the composition, so long indeed as this does not entail certain objectionable physical features, such as inability to be given a firm consistency, and a marked tendency to deliquesce—become wet and soft by absorption of moisture—during the storage for a moderate time. For export, however, and for the local manufacture, whether direct from the cane by milling or diffusion or from the jaggery, or grocery sugars, value of the jaggery depends mainly upon its available sugar contents. For purposes of comparison and also as rough approximation to fact, we may take it that the available sugar is worth 10 pies a lb. and the treacle 1 pie a lb. in their unmanufactured condition in the cane.

"A cane grown largely in the neighbourhood of Hospet in the Bellary district, said to be cut in 6th and 7th months after planting. Then green, mellowing to straw, yellow at knots, said to become yellow all over if allowed to stand some time longer in the fields. Rattan about 5 feet long and $1\frac{1}{4}$ inches diameter at butt. Straight grown, soft.

"Six rattans analysed at Nellikuppam on the 30th March, 1886. Were pulled by the roots on the evening of the 27th March.

Per cent. juice in the cane	90·91
Per cent. dissolved solid in the juice	19·7
100 dissolved solid consisted of—	
Sugar	75·
Glucose	22·1
Ash..	1·1
Unknown gums, &c.	1·6
Total	100·0

"Good milling of this cane would take out 130 gallons juice per ton (equal to 62·8 per cent.) and thence jaggery as before equal to 301·0 lb. per ton cane—as before with 20 tons cane to the acre, 2·68 tons jaggery.

			As before per acre. Rs. A. P.
The jaggery containing—			
Sugar per cent.	45·3	..	172 9 3
Treacle per cent.	54·7	..	20 12 11
Value of 1 acre of cane		..	193 6 2

"Four samples of large bulks of jaggery in the market examined in the years 1883 to 1886 showed a sugar (as distinguished from treacle) content of from 42·7 to 50·5 per cent., the average being 46·6 per cent.

"In the case of the above two varieties of canes, I am uncertain as to whether inferiority of the cane is owing to innate inferiority or to its unseasonable working. In the following cases, however, comparisons are of the canes as near maturity as they can be grown on the large scale, and therefore quality may be regarded as innate (this being certainly influenced by soil, it must be kept in mind).

"*No. 1-a*—What appears to ~~come to~~ me to the Otaheite Ribbon cane of the Mauritius and the West Indies, and I believe indigenous to the Malabar coast and originally exported to the Mauritius and brought thence into the south Arcot district some 50 years ago—grown in considerable quantity in the neighbourhood of Fellikuppam. Plant cane soft, usually 6 to 8 feet long, 1 inch to 1½ inches diameter at butt, tapering. Colour purple with longitudinal spaces of yellow or yellowish green. Spaces between knots, usually about 6 inches. Very little silicious matter on the rind even at the knots. Analysis, average, deduced from analyses made in a season's working.

"*No. 2-a*—A yellow or greenish yellow cane, plant cane soft, usually 5 to 7 feet long, ¾ to 1 inch diameter at butt, tapering. Spaces between knots usually about 5 inches. But little silicious matter on the rind, except at the knots where it occurs in some quantity, though nothing like to the extent as in the Chinese cane. Grown in considerable quantity in the neighbourhood of Aska in the Ganjam district. Analysis, average, deduced from analyses made in a season's working.

"*No. 3-a*—What appears to me to be identical with the Green Salangore of Trinidad, probably as its name suggests originally

imported there from the Straits, and probably directly imported here. Occurring among the ribbon cane grown in the neighbourhood of Nellikuppam, but not usually cultivated by itself. Plant cane soft, usually 7 to 9 feet long, 1 to 1½ inches diameter at butt, tapering. Colour green, mellowing to straw, yellow at knot when fully ripe. Spaces between knots usually between 6 and 7 inches. Very little silicious matter on the rind, though more at the knots than in the case with the ribbon cane. Analysis, average of 7 made at different times.

"*No. 4-a*—What appears to me to be identical with above. Imported into the neighbourhood of Nellikuppam in 1885 by Messrs. Parry and Co. from Coimbatore. A peculiarity noticeable in the first year of its cultivation here was its flowering in the 9th month after planting, purity co-efficient of the juice with arrow just forming of one rattan being 85·8; of another rattan with flower formed but not open, analysed on the same date, purity co-efficient 85·8 of 3 other rattans from the same field examined 18 days later, all with arrows fully formed and seed also apparently through these were not fully dry, the co-efficient of purity of the mixed juice was 85·5, and 15 days later again of 3 rattans from the same field, one flowered and flower fully ripe had purity co-efficient of 94·3, and two other rattans just throwing arrows which were green and very soft, purity co-efficient of the mixed juices was 88·2.

"*No. 5-a*—The same cane as No. 4, grown at Kumbakonam in the Tanjore district from seed tops obtained from Coimbatore. Advised as being 8 months old. Cut 5 p.m. of the 18th March, 1886. Analysed mid-day 20th idem.

"*No. 6-a*—Coimbatore cane as Nos. 4 and 5 received direct from Coimbatore. Analysis of the juice of a bundle of 324 lb. received 24th January, 1887.

"*No. 7-a*—A red or brown purplish cane. Colour deepest in middle of joint paling towards the knots. Plant cane soft, joints unusually short, 4 to 5 inches, and restricted at knots. Length about 8 feet and diameter at butt 2 inches. Very little silicious matter on rind or knots.

"*No. 8-a*—A cane like a very small Chinese, grass-like, and though rattans mellow, yellow throughout, length leaves (dead) removed with difficulty even from lower joints. About 4 feet long, ½ inch at base and ¼ inch at tip. Joints with white silicious incrustation as with Chinese. Analyses of a bundle sent from Shiyali. Cut on 26th April, 1886, at 5 p.m., analysed morning of the 28th idem.

"Good milling of the canes from 1-*a* to 7-*a* inclusive, as with the Bellary cane, would take out 63 per cent juice, but from 8-*a* in consequence of the very fibrous character of the cane, would not take out more than 40 per cent.

"In the cases of Nos. 3 and 4 above, analyses and thence comparative valuation have been deduced from analyses extending over a season or more working and may be accepted as average in fair season. In the case of No. 5, average analyses and valuation cannot be spoken to with so much certainty but they are the results of 11 analyses of canes grown in three different places and have a value approximating to that of averages. As to the analyses and valuations of these canes, *i.e.*, what their so-far ascertained potentialities for sugar-making are, it would seem that the Green Salangore shows a better composition of juice than any of the canes grown in Barbados by Messrs. J. B. Harrison, Inland Professor of Chemistry and Agricultural Science; and J. R. Bovell, Superintendent, Botanical Station, Barbados, in their experiments on the value of certain varieties of sugar cane, reported to their Government, September 1, 1886."

[The remainder of the letter has already appeared on pp. 516, 517, and 518 of our October issue.]

UNITED STATES.

Continuation from page 582 of M. Santiago Dod's communication to the Fort Scott *Daily Monitor*.

Sorghum Sugar.

In regard to the production of sugar from sorghum, I have, since the first successful attempt to obtain sugar from this new source, always supposed that the history of the manufacture from the beet root would be repeated step by step through the same course of progressive development, until equally brilliant results were reached; and what I have observed at the Fort Scott factory fully confirms this belief. The beet at the beginning only contained five or six pounds of sugar to every hundred pounds of roots, and the idea of obtaining a profitable yield from such inferior raw material was as much derided as the same expectation from sorghum has ever been. Nevertheless, by scientific fertilization and selection of the seed, the despised root has been gradually brought to such perfection as a

sugar producer that it is now richer than the average tropical cane, and the over-confident cultivators of its rival have been brought to sue for protection against its advances. At the same time that the plant was being developed to this high standard, the machinery and processes of manipulation have also been carried to surprising perfection, and to such an extent that the whole eventful history of the European sugar industry is one of the most notable examples the world can show of what science can accomplish in agriculture and manufacture. There is nothing as yet manifested by the experience of your industry, which goes to prove that science and perseverance may not do as much for sorghum as it has for the beet, whose progressive career is so clearly pointing out the path to a final triumph. The sorghum industry is, however, suffering from one great impediment, which the primitive beet manufacturer escaped. His product, during the infancy of the enterprise, when it needed aid, was worth double the price it is at the present time, and furnished ample means for surviving a costly apprenticeship. If the great fall in the price of sugar had overtaken the manufacture from the beet root before it was perfected, as it did the sorghum industry, it is probable that the world would still be dependent upon the tropics for its only supply of sugar. Had the old prices which nurtured the European product in its hour of need, been maintained until the present time, the sorghum industry would to-day with the advancement already made, be a profitable investment, attracting the capital and knowledge requisite for its complete development.

The machinery for the manipulation of sorghum has been so improved that comparatively little more is needed, but that indispensable scientific education of the plant to a higher sacchariferous value which has made the beet root a success, is unfortunately barely begun, and it is evidently upon this phase of its progress that the energies of its pioneers must be concentrated. The great purifier of saccharine juices both in the factory and the field as far as my limited knowledge enables me to judge, is phosphoric acid, and this agent must be liberally used, both in the culture of the plant and the treatment of its juices before adequate results can be attained. The effect of this valuable aid is so well recognized in Europe that it is always applied as a fertilizer, and the roots to be worked at the commencement of the campaign receive a double dose, in order to perfect them early in the season. It may be safely said that without this important auxiliary the beet would never have attained its present industrial value. From new

fertile lands even in the tropics, and from sugar cane which is by nature the most perfect of sacchariferous plants, we cannot obtain rich, pure juices without the help of manures to counteract the deleterious tendency of the excess of organic matter in the soil. It would appear then that a high yield of sugar should not be expected from the new soil about Fort Scott without this aid, and much less having to deal with an unperfected plant. Nor can it be hoped for from careless husbandry and the half-cultivated weedy fields to which many farmers seem to trust. Reasoning from analogy, I suppose that to obtain a good crop of sugar from sorghum, the land should be plowed and cross plowed to a depth of at least fifteen inches, following the mouldboard with a subsoil plow ir the same furrow, and afterwards harrowing well the land to make a good seed bed. Also that only the seed from the stalks with the richest juice should be sown, and that the seed from the plants which are earliest to ripen should be kept separate and planted apart from those which mature later, so that the whole crop of each field may be fit to harvest at the same time. The admixture of unripe and over ripe canes with those that are in that stage of maturity which gives the highest yield of sugar, cannot possibly secure maximum results. The soil should undoubtedly be liberally fertilized with phosphates, and judging from what is practised with the Alipore sorghum in India, the seed should be cut or stripped from the plants as soon as it appears, in order to oblige them to concentrate their vegetal energies wholly upon the production of sugar instead of grain. The soil should be kept entirely free from weeds, and the surface constantly pulverised by cultivation until the crop begins to mature. If all this be done, I can see no reason why the yield should not increase year by year until a profitable crop of sugar from sorghum becomes as certain as that from the beet or tropical cane, for it seems quite evident from the results already obtained, that the plant admits a much higher sacchariferous development than has yet been reached. The new hybrid to which the name of Coleman cane has been given, has, according to a recent statement by but two propagations from properly selected seed, attained nearly 20% sucrose, which is much higher than that of the average tropical cane from which half of the sugar consumed throughout the world is produced. It appears also that in one of the remote mountainous districts of India sugar has been obtained from sorghum time out of mind, by the rude primitive methods there in vogue. Seed from this new type have been distributed by the agricultural

department, and it may reasonably be supposed that, with our higher civilization and industrial facilities, we should obtain from this new source plants of a sufficiently perfected type to found a safe and profitable industry. The juice of the sorghum being in the present semi-perfected condition of the plants so impure, it seems evident that every available means, besides lime and heat, should be utilised in the factory to modify or correct this defect if possible, and judging from its effect upon tropical juices the pure phosphoric acid made in St. Louis under the name of "Clariphos" is a reagent that might be generally employed to this end. This same defective quality of the juice also calls for important modifications in the vacuum pans used for granulation. The present form of construction in common use is very imperfect even for the treatment of the purest saccharine liquids, and far more so for sorghum syrups. The "masse-cuite" in a state of ebullition should be as shallow as possible, and the pans should therefore be broad and not deep; the heating surface should be so ample that more than two pounds steam pressure need not be used, and the most perfect circulation devoid of conflicting currents should be obtained in order to avoid unnecessary attrition of the grain. The vacuum should be as complete as the best constructed air pumps permit. It is also probable that the old system of forcing granulation by periodical changing should give place to that of a continuous supply. Besides the many other difficulties and impediments the manufacture of sorghum sugar suffers like all other new industries, from the want of trained workmen. These cannot be improvised, and can only be obtained after long experience has induced a settled adequate routine, and even then perfect work will only be attained as it is in other manufactures, by the selection of the best. In my frequent visits to your sugar factory what I have seen seems to indicate, that those who have already accomplished so much are upon the verge of a complete success, and will soon confer a great boon upon the whole country by firmly establishing a new industry eminently adapted to the soil, climate, and necessities of a large section of territory, contributing greatly to the prosperity of your farmers. Judging from the effect of a long drought upon tropical cane, the past season must have been an unfavourable one for sorghum, nevertheless, the factory at Medicine Lodge has obtained from 80 to 100 pounds of sugar to the ton. This with economy is undoubtedly a paying yield. Other factories will sooner or later reach the same level, if they have not already, and safe

returns being once assured, the requisite capital will not be wanting for further improvement. In time they will probably become refineries, melting foreign sugars with sorghum juice during the harvest, and working them alone the rest of the year. The refining process would probably so improve sorghum molasses that it would bring the highest price in the market, and largely augment the present returns. With all the progress that has been made the margin left for improvement is still large, and this is the most encouraging feature of the whole enterprise.

UNITED STATES.

Letter to the *Louisiana Planter*.

ECONOMY ESSENTIAL.

The sugar planters of Louisiana have been favoured with exceptional weather for cultivating and taking off their crop, and with extraordinary result of thirty, forty, and even fifty tons of cane to the acre, and the majority will probably make a little money this year in spite of the low prices prevailing for sugar and molasses.

But a season like this only occurs every twenty or thirty years; indeed the oldest planter can hardly recall such phenomenal yields, whilst there is unhappily every reason to believe that the present low range of prices is likely to be permanent.

It is reported in the newspapers that granulated sugar is offered for sale in Philadelphia, deliverable after the 1st of April, at 4¼ cents per lb. This puts our yellow clarifieds, which are the bulk of our crop, at 3 to 3¼ cents per lb., so that if the bounty of 2 cents per pound is given, we cannot expect more than 5 cents as an average price for future crops.

At this price of 5 cents per lb., and with our usual yield in Louisiana of sixteen to twenty tons per acre, it will be impossible for the average planter to make any money and keep up his plantation, if he continues to pay the present rate of wages, and they should be reduced, as in 1885, to 60 or 65 cents per day.

Now that the grinding season is nearly ended, this question of what wages should be paid seems to me most opportune, and I hope that you, Sir, by means of your widely circulated paper, and the Sugar Planters' Association, at their next meeting, will obtain the views of those interested, so that, if possible, there may be concert of action in this important matter.

BEET CULTIVATION IN SCOTLAND.

The *Glasgow Herald* of June 7th after referring at some length to the interesting papers on the subject of successful in sugar beet cultivation in England and Ireland, which have from time to time been published by Dr. Schack-Sommer of Liverpool, and which have been reproduced more or less fully in our columns during the past year, makes the following remarks on the subject with a reference to the possibility of the growth of beets for sugar making in the Clyde district:—

"On the scale these experiments have been carried out, it is possible results may be somewhat misleading, but, even allowing a fair margin, a crop of this description to yield from 12 to 15 tons per acre, at little over the cost requisite for an average turnip break, is surely worth some attention. Turnips consist of 90 to 95 per cent. of water, while beets have only about 80 per cent., and the other feeding properties are much more valuable than those of turnips. Red beet, carrots, and parsnips grown alongside of these sugar beet with the same manuring, proved a comparative failure last season, and the potato crop in the west country has been a greater failure than for many past seasons. It is possible, nay even probable, that for some years to come our country may be handicapped by the bounty system of Germany and France to such an extent as to render profitable beet-growing for the production of sugar almost impossible to our farmers, but, like other evils, this system cannot last always, and our agriculturists may look a few years ahead to opportunities of successfully competing with the foreigner in producing our own sugar. Canada, our colonies, and the United States are seriously taking up the question of beet-growing, and with Greenock at our doors, with fortunes sunk in sugar-refining plant, the Clyde district stands well placed for taking its full share in it, always provided, as it appears now probable, the cultivation of this crop can be adapted to our soil and climate. Already, it is stated, a company has been formed for establishing beet sugar factories in England, and neither capital nor enterprise is wanting to follow suit here when it can be shown the raw material can be produced to advantage. As an article for table use the smaller and more tender white sugar beets are quite as palatable and much sweeter than the ordinary red garden beetroot, which contains little over one-third of its saccharine richness."

We do not see why certain districts of Scotland where farming, as is well known, has been conducted on a very high scale for some time, and where the soil is naturally fruitful, yielding exceptionally good root crops, should not be as well adapted for sugar beet growing as parts of England and Ireland, where it is believed to be possible as a commercial success. What is wanted is for the subject to be well ventilated, and for capitalists to be induced to take the matter up. It is difficult to believe that our friends north of the Tweed, who are usually credited with an uncommon sharp eye to the main chance, would be slow to avail themselves of the opportunity, if they once "saw money in it."

ESTIMATES OF THE COMING CANE SUGAR CROPS.

	Mr. Licht.		*Prager Zuckermarkt.*	Mr. Görz.
	1889-90.	1890-91.	1890-91.	1890-91.
Cuba	536,638	675,000	700,000	700,000
Porto Rico	59,634	45,000	40,000	55,000
Trinidad	47,870	50,000	50,000	50,000
Barbados	71,173	65,000	60,000	45,000
Martinique	36,022	35,000	40,000	35,000
Guadeloupe	47,527	50,000	50,000	50,000
Demerara	116,114	115,000	105,000	105,000
Brazil	150,000	180,000	170,000	190,000
Java	331,951	360,000	350,000	350,000
Philippines	116,175	160,000	180,000	200,000
Mauritius	123,985	115,000	120,000	115,000
Réunion	36,375	40,000	35,000	35,000
Jamaica	30,000	30,000	20,000	20,000
Lesser Antilles	28,000	30,000	45,000	28,000
Louisiana	128,000	175,000	175,000	175,000
Peru	30,000	30,000	40,000	45,000
Egypt	35,000	40,000	50,000	45,000
Hawaii	125,000	125,000	120,000	125,000
	2,049,464	2,320,000	2,350,000	2,368,000

THE JAMAICA EXHIBITION.

According to latest advices the building and its appurtenances were in a forward state and rapidly approaching completion, and it was believed that the arrangements made by Mr. Lee Bapty and the Commissioners would result in everything being fairly ready for the opening day.

We are enabled to give a list of the exhibits which more especially relate to the sugar industry, supplemented by descriptions of some of the principal machinery, &c., shown by leading English and Scotch firms.

GREAT BRITAIN.

Aitken, McNeil and Co	Sugar machinery.
Anglo-Continental (late Ohlendorff's) Guano Works	Peruvian Guano and other manures.
Edward Elwell	Plantation tools.
Thomas Farmer and Co	Fertilizers.
George Fletcher and Co	Engines, centrifugals, and other sugar machinery.
McOnie, Harvey and Co	Sugar machinery.
James March Reid	Fertilizers.
Duncan Stewart and Co	Sugar machinery.
Watson, Laidlaw and Co	Do. do.

DEMERARA.

Donald Skekel	Model sugar mill.

CANADA.

Aurora Agricultural Works	Agricultural implements.
Cockshutt Plow Co	Do. do.
Steel Harrow Co	Harrows and cultivators.

UNITED STATES.

Nervelle Universal Mill Co	Sugar machinery.
Charles A. Nordyke	Do. do.

GERMANY.

F. A. Helen and Co	Sugar cane and other knives.
P. D. Rasspe Söhne	Sugar cane knives and hoes.
Gebrüder Schüchoff	Cane cutting implements.

Mr. EDWARD ELWELL, proprietor of the old-established Wednesbury Forge, shows a large variety of the West India, P., and Crown West India hoes for which the firm has been celebrated for over three quarters of a century, together with a number of cane bills and bill hooks, axes, and other implements especially adapted for the cane and similar colonial industries.

THE ANGLO-CONTINENTAL (LATE OHLENDORFF'S) GUANO WORKS have a varied display of Ohlendorff's dissolved Peruvian Guano, Special and Early Cane manures, sulphate of ammonia, nitrate and sulphate of potash. We have frequently alluded to the remarkable results obtained by the liberal and judicious use of these well-known manures (see more especially pages 229, 366, and 451 of our last year's issue, and the last Report of the Results obtained at Dodd's Reformatory, Barbados, of which we shall give a summary next month), and we may mention that this company are now the sole importers, by special sanction, of the Peruvian guano in Great Britain, Germany, Holland, Belgium, and the North of Europe. The wonderful increase in the crop in Barbados last year, which has surpassed the expectations of even the best informed, is attributed mainly to the use of Peruvian guano and other similar fertilisers, to the preparation of which this firm has devoted the closest attention.

Messrs THOMAS FARMER AND Co., Hall's Wharf, Victoria Docks, London, offer bone manures, superphosphates, and chemical guano. Their works have been established over a century, and they are noted for the genuineness of their articles, which are well-known in the West Indies more especially.

Messrs. MCONIE, HARVEY AND Co., Scotland Street Engine Works, Glasgow, are showing a Thompson and Black's patent five-roller sugar cane mill, having rollers 16in. diameter and 24in. long. This type of mill has been successfully introduced by the firm in the West Indies, Mexico, Brazil, and Peru. In Brazil especially it has been received with great favour, and the results obtained are said to be unsurpassed. One of the largest mills of this class which Messrs. McOnie, Harvie and Co. have yet made, the rollers being 32in. diameter by 72in. long, has been at work for the past three years on a well-known plantation in Demerara. The mill exhibited at the firm's stand is the smallest of the five-roller type yet made by them, but it is nevertheless a true and complete model for any size of mill.

Messrs. WATSON, LAIDLAW AND CO., Dundas Street, Glasgow, show amongst other machinery a pair of Weston's patent centrifugals with friction pulleys, and a high-speed engine expressly adapted for working centrifugals, which present special features and appliances.

Messrs. DUNCAN, STEWART & CO, London Road Iron Works, Glasgow, extensively known as the patentees and manufacturers of hydraulic appliances for sugar mills, which have been adopted, and are now working successfully on nearly a hundred estates and factories in all parts of the West Indies, Java, Louisiana, the Canary Islands, Philippines, and at Sydney, are exhibiting two cattle mills, viz., one 12in. by 18in. three-roller cane crushing mill, and one 8in. by 10in. complete sugar mill, also an inverted donkey pumping engine, also a 24in. mill with double gearing and engine complete. The latter could not be shipped in time for the opening of the Exhibition, owing to the unfortunate railway strike in Scotland; we shall give a detailed description of it next month.

Messrs. AITKEN, MCNEIL & CO., Colonial Iron Works, Glasgow, manufacturers of all kinds of sugar machinery, are exhibiting a model of Thomson & Black's patent five-roller mill, which is said to deliver 70 to 80 per cent. of juice on the weight of canes, and has the peculiarity of having two *splitting rollers* placed in front of and above the ordinary three rollers. It possesses among other advantages that of the exposure of the crushed canes to the atmospheric influence being only momentary before they enter the three-roller final crushing mill, so that no fermentation takes place, and further the two roller arrangement can be added to existing three-roller mills. This mill obtained a first class award at the Melbourne Exhibition.

Messrs. GEORGE FLETCHER AND CO., of London and Derby, who are well known in all sugar-producing countries as makers of every description of machinery utilised in the manufacture of sugar, are entitled by their long experience in the business, combined with the high-class quality of the work turned out, to rank in the foremost position, and they are exhibiting two of their improved 30in. Weston type-centrifugal machines and pug mill, driven by a horizontal steam engine. The machines, which are of the type usually supplied by this firm, are exceptionally strongly built, in order to withstand the rough usage frequently experienced on sugar estates, and are also fitted with the most modern improvements. The baskets are fitted

with Liebermann's endless wire gauze lining and bottom discharge. The main driving shaft is supported on swing bearings, which counter-balance any slight unevenness of the floor or foundation, and the driving wheels are fitted with improved friction gear of extra strength.

This type of machine requires less power to drive it than any other; it runs perfectly noiselessly, performs more work, and is entirely free from vibration; it is easily emptied and cleaned, thus ensuring a minimum amount of labour, and consequently economy in working. They can be erected on a wooden frame or placed upon the floor, thus requiring no expensive foundation, and further machines can be added to existing plant without alteration, provided there is sufficient power to drive them.

The engine is one of the horizontal banjo type, with double fly wheels, each of which is of sufficient size and strength to transmit the whole of the power given out by the engine. It is fitted with an automatic expansion gear controlled by a highly sensitive governor, which ensures the greatest economy of steam, a very great consideration, especially on estates where the exhaust steam is not used for boiling purposes, or where the centrifugal plant is some distance from the evaporating pans. The steam cylinder is 10in. diameter by 20in. stroke, and is suitable for driving six centrifugal machines, although but two are exhibited; they are, however, designed so that more can be added at pleasure.

Messrs. Fletcher and Co. are manufacturers of every arrangement of centrifugal machines for hot or cold curing, and fit them either with a pug mill or mixer, or a pug mill and mixer combined.

They also frequently supply an installation in which the massecuite is delivered from the sugar boxes into the pug mill or mixer above the centrifugals, the cured sugar from the machines being discharged through the bottoms of the baskets on to a conveyor, which delivers it to an elevator, and this latter raises it to the sugar storeroom above. The whole of the operation being automatic, with the exception of starting and stopping the machine, one good workman in this case is sufficient to look after two machines, whereby a great saving of labour is effected.

Messrs. Fletcher and Co. also exhibit some photographs illustrating different arrangements of centrifugal machines as made by the firm, together with engines specially designed for driving them.

The pair of photographs represent two views of similar machines to those now exhibited, while those below are arranged with a mixer and pug mill, the latter not being shown. One of the photographs also illustrates the engine exhibited, while the other is an angular engine, suitable where it is necessary to place it upon the floor, and where it is advisable to keep the driving bolt well above the ground, as in the case of swampy localities. These engines have also the advantage of being self-contained on one bed plate, without an independent outside bearing. Mesrs. Fletcher also supply an engine of a neat design, and of the ordinary type, which is suitable where a good foundation can be obtained.

Some indicator diagrams taken from the engine exhibited are also shown, which clearly show the action of the expansion valve with the engine running under different loads.

Altogether the finish of the exhibit is fully up to the high standard of excellence by which this firm have obtained their reputation.

The well-known fame of JAMES SHEARS & SONS, Engineers, London, have just brought out a New Multiple Effect Rapid Film Evaporating Apparatus (Slaiter's patent), for concentrating sugar, chemical, or other solutions. Although this is not being shown at the Exhibition, it will be brought under the notice of planters and others interested who are visiting Jamaica, and a description of it may therefore not be out of place in connection with the above notices of exhibits.

The principle of this new Transit Evaporator is the rapid passage of the cane juice or other fluid to be concentrated in thin streams or films over channels and through return pipes which are open to a vacuum chamber and heated by steam.

The general principle of the complete apparatus is as follows:—The thin streams of fluid, traversing the channels and return pipes of the first vessel under steam of about 5lbs. pressure and a low vacuum, give off vapour of sufficient temperature to concentrate a similar quantity of fluid traversing the channels and return pipes of the second vessel under a superior vacuum, and the vapour from this second process will in turn evaporate the same quantity of fluid in a third vessel under a still higher vacuum, allowing for loss by condensation.

In the ordinary Multiple Effect Apparatus the process of concentration requires several hours, owing to the great quantity and

inefficient circulation of the fluid under treatment; and if cane juice is being treated, causes the formation of uncrystallizable sugar.

The new Transit Evaporator is constructed with either single, double, triple, or quadruple effect, in each case of sufficient capacity to concentrate the fluid under treatment to the required density at one operation, after being exposed to heat only a few minutes.

Each vessel is cylindrical, and composed of a large central vacuum chamber, divided into steam and condensed water chambers at the ends, through which a number of large readily removable evaporating tubes are arranged in vertical rows.

Each of these evaporating tubes is divided by a diaphragm forming a channel running the entire length, over which the cane juice or other fluid runs in a thin stream, the upper part of the tubes being open to the vacuum chamber enabling the vapour of the evaporated fluid to pass away, the lower half forming a steam space. In the lower half or steam space of these evaporating tubes a copper pipe, open at the ends to the vacuum chamber, runs the entire length, and this pipe, in addition to evaporating, serves to return the fluid which is under concentration, and deliver the same by means of a hollow bent elbow into the channel of the next lower tube. The tubes project slightly through the ends of the vessels, being closed at one end by means of loose caps, which are held in place in sets of three by means of a triple-armed frame with a centre bolt; at the other end the connection from tube to tube is made by means of removable hollow bent elbows, also held in place by a centre bolt. The tubes and channels of the first vessel are partly heated by the exhaust steam of the air pump engine, provision being made for the admission of additional steam. The tubes of the second vessel receive their heat from the vapour released from the open channels and the ends of the return pipes of the tubes of the first vessel, and so throughout.

Each tube can be quickly removed or re-inserted if required, the accompanying return pipe being also removable apart from the tube. The tubes are so arranged as to admit the movements of a workman inside the vessels if necessary. The channels can be cleaned either from the inside of the vessels or from the end on removing the closing caps. The evaporating return pipes can be cleaned from either end, or removed, if preferred, and others inserted.

The Action is as follows:—

The cane juice or fluid is admitted into the open channels of the uppermost tubes in the first vessel, and, after traversing their lengths

in a film over the heating surfaces, returns by way of the accompanying pipes in the steam spaces and hollow-bent elbows into the open channels of the next lower tubes, and so throughout the series. The fluid finally discharges into a small closed vessel, whence it rises by difference of pressure into the channels of the uppermost tubes of the next vessel or effect, where the process is repeated.

The apparatus is entirely automatic throughout, and the fluid or cane juice, once admitted into the open channels of the first vessel, requires no further attention, finally emerging in a finished state at the desired degree of concentration, preparatory to being passed to the granulating vacuum pan.

CUBA.

THE COST OF COAL AT SAGUA.

From the "Revista de Agricultura."

In corroboration of what we have previously maintained in this journal, with regard to the impossibility of our sugar plantations employing coal as fuel in consequence of its being made so much dearer by the new duties imposed upon it, we give below the price of that mineral, delivered at the works in Sagua, according to our contemporary, *El Comercio*, of that place.

	$ c.
1,000 Kilos. (2,200lbs.) of coal of the kind ordinarily consumed in works, put on the railway wagons, cost	8·00
Import duty	0·72
Tonnage dues	1·00
Average carriage by rail	1·00
	$10·72

It is thus absolutely out of the question for the factories to use this kind of fuel, without increasing beyond measure the cost of production; whilst if the government should decide to grant the complete exemption from taxation of an article so vitally necessary to the industry, it would be possible to sell it at an average price of $6, plus the railway carriage, which again might be reduced, and then the metric ton would cost, delivered at the works, $7, at which price it could be used in the manufacture of sugar.

MAURITIUS.

PLANTING.—Very few changes have been made in methods used in planting "tops" for future crops since the early introduction of sugar cane into the Mauritius. The vertical planting, as has been suggested of late years, has not met with the expected success; the same may be said of planting two "tops" slotting or crossing each other. The old-style horizontal method will continue for many yearsto come.

Canes are replanted every three, four or five years, depending upon system of cultivation adopted. Harvesting of first or second "repousseè" is frequently followed by planting, in which case 2,800 holes are made per acre; these are in straight lines and alternate with those previously existing. With the view of having the crop uniform, these holes are made several inches deep and wide, and are dug from time to time, while planting at once follows. This requires but a few days, the requisite fertilizer being introdnced simultaneously with the cane cutting. Such handworking of the soil is tedious.

The *Revue Agricole** published some time since several interesting facts relating to the comparative cost of hand and mechanical methods. For example: taking out old stubble by the hour costs $3 per acre; by oxen and plough, $1·60, second operation; holes for "tops" 20 inches long and 12 inches wide and 20 inches apart; rows 4 feet apart, $3; by deliver, $1·12. These figures are sufficient to show beyond cavil that there is, from an economic standpoint, great advantage in mechanical appliances over the old method. When machinery is generally introduced it will be far easier, even than at present for Mauritius sugar to compete with the world.

The Mauritius sugar factories, taken as whole, compare favourably with those exisiting in any sugar-cane island, either in the West Indies or elsewhere. The processes adopted are in many cases the outcome of circumstances; for example: Sugar sent to India must have been extracted without using animal substance; this is a religious demand of that country. As a consequence the use of bone black has become almost a question of the past, sulphurous acid is employed, and is said to have the desired decolourizing effect. As in all these methods of working mill juices, there is a constant conversion into glucose. Excellent results have been obtained in efforts to prevent this, by using pure phosphoric acid. Ehrmann has been the main mover in this direction.

* This journal is published in Mauritius and edited by M. de Grandpré.

Pumps, *monte-jus*, etc., are in very general use, and were noticed in factories visited. In several cases new filter-presses are being introduced. Centrifugals are placed in rows, and we noticed that a spray of syrup is added during swinging out; the intention evidently being to produce a high grade sugar with low colour for countries where the Dutch Standard is in vogue. In some factories they have tried the experiment of making a very large crystal for the Australian market. These are mainly for brewers' purposes, and are not profitable to the manufacturer, owing to the time and care required for their production. On the other hand, small-grain grades are very popular. The location of many factories is too far from a suitable water supply, hence the necessity of cooling the water after leaving the exhaust, with the idea of using it over again.

A few figures relating to "Highlands" will give an idea of the condition of that factory during our visit:—

Average sugar per diem	45,000 pounds
Total sugar made up 21st December, 1889	5,060,000 pounds
Working days, 17th July to 21st December, 1889 ..	110 days
Average sugar yield per acre	4,289 pounds
Average juice per cask.........	55 gallons
Average sugar per cask	7,061 pounds
A portion of same crop was weighed, viz.	2,352,852 pounds
The resulting juices from same	5,394 casks
Total sugar from same...........	378,960 pounds
First sugars from 67,739 cubic feet *masse cuite*	1,598,550 pounds
For defecation, etc., there were used, sulphur, ...	12,864 pounds
For defecation, etc., there were used superphosphate	14,450 pounds
For defecation, etc., there were used, quick lime....	34,442 pounds

At the Britannia estate:—

Men employed................................	748
Total acres of cane cut	807
Total sugar made (from virgin canes, first and second *repousse*)	3,800,000 pounds
Average per acre	5,000 pounds
Average daily extraction	43,000 pounds
From 14th August, 1889, to 18th January, 1890 ..	323,572 pounds
Quantity of sugar shipped	3,383,313 pounds
	3,706,885 pounds

It is very difficult to obtain the exact cost of manipulation in the mill; 13 Rup. per 1,000 pounds of sugar is very near an average, representing about one-half cent. per pound. Total expense, including purchase of cane, etc., 77 Rup., or 29 cents per pound.

DIFFUSION.—For many years past Mauritius sugar manufacturers have watched with keen interest the results obtained by diffusion at Almeria (Spain), Louisiana, Java, etc. While the sugar yield in these experiments was greater than by any of the manufacturing methods hitherto applied to sugar cane, the cost of plant, the evident increase in quantity of fuel needed for evaporation, combined with other more or less complex reasons, have considerably retarded any financial encouragement towards these inovations, though strongly urged by the agricultural and other societies of the island. The Oriental Bank sugar estates will be the first to move in the direction of progress. The Britannic factory will have for the coming campaign a battery which will be of the very best Five-Lille type. We are informed that the agreement is, that the apparatus shall be returned if not satisfactory after several years' trial.

Special arrangements have been made between the government of Mauritius and the foregoing sugar estates, so that if the battery is ultimately purchased, the drain will not be too great on either interested party. The local government to meet this extra expense, proposes an additional surplus tax on sugars exported; brokers exporting sugar will evidently in part pay for the improvement.

If the experiments at the Britannic prove a success (as they most certainly will under the management of a director, who has a thorough knowledge of sugar in all its phases), they will create an era of sugar in Mauritius. The average sugar extraction would be raised two or three per cent., and other countries would be likely to follow the example given. This will not be realized without certain difficulties for very few sugar men of the island have ever seen a diffusion battery either working upon cane or beet. Those who have, are not financially interested in this new venture. We cannot, at present writing, discuss the most desirable way of assuring success; one fact is certain, the work could not be in better hands.

It is very doubtful if the *bagasse* of an ordinary mill will be sufficient to meet the requirements of the case, for additional fuel will be required. The surplus expense and details of the practical results obtained, after first campaign, have been promised us; we can then

judge exactly what has been accomplished and what may be expected in the future. The best methods of working a mill in Mauritius consist in having sufficient *bagasse* left over with which to commence the campaign the following year.

The burning of this fuel in the Godillot furnace on several estates has given satisfaction. It was estimated that there would be considerable saving of time and labour to run the refuse from mill into furnace direct, without preliminary drying. On the other hand, it was a question whether there would remain over any bagasse when the campaign was ended. On several estates visited by the writer the large sheds filled with this dried refuse attracted considerable attention. The ash from furnaces—as in all cane-growing—is used as a fertilizer. Enterprising capitalists discuss from year to year the profits that might accrue from manufacturing paper from bagasse. The question remains to be proved whether the value of paper made would be equal to the expense of fuel required at the mill.

SOILS.—One of the most interesting questions relating to sugar in Mauritius, is the great variety of soils suitable to cane growing. Planters vary in their views respecting the most desirable conditions, combining yield and quality of cane raised. By many it is asserted that the lower levels near the sea are warmer, better protected, and give the richest canes. It is, however, sure that sections of the island yielding some years since excellent results, have now been abandoned, either from the fact of the soil having been nearly exhausted, or that irrigation in certain instances has been difficult, and frequently impossible.

Soils at different elevations not only vary considerably in their composition, but in moisture, the outcome of frequent rains; for example: we saw canes growing with satisfactory results, where the annual rainfall was 200 to 300 inches; and in other localities the yield and sugar percentage was even better, but with a fraction of the above-mentioned rain. The soils in those very wet districts are porous, and a few hours after a rain are almost dry. The fact that such rapid infiltration should exist, necessarily causes great difficulty in retaining the fertilizers at a depth where they are most needed; these are therefore often carried to lower levels, belonging perhaps to another planter who derives benefit at the expense of his neighbour.

One need only examine the difficulties to be contended with, to at once appreciate the advantage, in many cases, of existing primitive

methods of working. We very much doubt if in the whole history of agricultural progress, an instance can be cited of attempting the growing of a crop on solid rock; but such are the practical efforts in many cane centres which we visited. The lava, where it exists in lumps, is raised from its bed and thrown to one side; the soil underneath is dark in colour and very fertile; spaces between these lumps are frequently planted with cane. In many respects the lava environment has advantages, such as rapid absorption of moisture and throwing it out as the ambient temperature increases, just at the period when the young plant is in the most need of the same. The tedious planting of cane under the foregoing conditions, may be appreciated when it is known, that the cost of labour alone aggregates several times the primitive purchase value of the land. When hands may be had for three or four dollars a month, the labour problem is very different than it is with us.

As regards improvement in existing methods of working the soil, great credit is due to Mr. Nash, manager of the Oriental Bank estates. He is thoroughly awake to the importance of ploughing, &c.; and during the past season strong efforts have been made in that direction. At the Britannia sugar estates the lands were being ploughed during our visit. The operation was easy, owing to the almost perfect level condition of the locality. The objection offered by many planters is, that ploughing would loosen the soil, and canes, when attaining a certain height, would not hold well in the earth. Such, however, has not proved to be the case. As to the direction selected for the rows, experience will show which is most desirable. Questions of winds, sun, and slant of soil are all to be considered.

Artificial Manures.

The Mauritius planters are awake to the importance of a liberal use of fertilizers; and an interesting fact is, that the cost of guano, the most popular of all fertilizers used, is the greatest expense to be contended with in cane cultivation on the island. Planters, in most cases, use this fertilizer because it has given satisfactory results in the past.

The difference of composition, &c., of soils in one place, as compared with another, are questions which have been too long neglected, but are being considered at present. Satisfactory results have been obtained with 4oz. guano per hole—700lbs. per acre; for virgin canes there are added 6lbs. barn-yard manure, or 8 tons per

acre, costing $4·00 a ton, or $32·00. The fertilizer obtained as a residuum, after using Ehrmann's method for working cane juices, has rendered excellent results, owing to the sulphur and phosphate of lime it contains. Phosphoric acid and lime are both required for proper development of plants, more especially in cases like Mauritius, where these elements are frequently not found in the soil in sufficient quantities.

Some planters are only recently appreciating that guano alone cannot possibly meet all the requirements necessary to re-establish lost fertility; year after year certain plant-foods are extracted; their nature would show exactly in what should consist the typical fertilizer for that special case. We were informed that systematic experiments are now being made under the guidance of an agronomist from a well known experiment station of England. Several types of fertilizers will be used, on exactly same conditions of soil, location, &c. Every known variety of cane will be used in these experiments; and those who have confidence in the ultimate results do not hesitate to say that the best sugar days of Mauritius were not in the past, but are to be expected in the future.

CANES.—The most popular cane now used in Mauritius may be said to be the Port Makay from Australia; other types such as the Bourbon, Losier, &c., have also given satisfactory results. The yield of these canes per acre varies with the soil and locality; it may, however, be estimated at 20 tons.

The question of obtaining a variety of seed suited to a special environment, continues to be constantly discussed. Since the recent discovery at Barbados, planters are willing to admit that cane selections may be made very much on the same basis as with beets. Some contend that the difficulty in securing cane seed is due to the incomplete maturity of the plant. Nothing prevents a scientific, methodical analysis of canes, with a view to selection; canes obtained from cuttings rich in sugar will have the same characteristics; we fail to understand why it has not long since been done.

Most factories grow sufficient cane to meet their own requirement, and when necessity demands it purchase from farmers—who are mainly Hindoos remaining in Mauritius after their contract period of labour has expired. This method has given great satisfaction, and the advisability of starting a central factory with entire dependence upon these tillers, is being seriously discussed. Canes are frequently

purchased at a rate of 4 to 5 Rupees per 1,000lbs. If we admit 8 per cent. extraction, then 80lbs. sugar in the cane cost $1·30. If we add cost of manipulation, the cost of 1,000lbs. sugar will be $26·00 or 26 cents per pound. This cost must not be taken as a certain basis, as there is an immense variation between factories, depending upon facilities and perfection of plant.

Analysis made by Ehrmann upon a considerable quantity of Mauritius cane during 1888-89, gives an excellent idea of the sugar percentage at different periods, viz. :—

Months.	Sugar variation.		Purity co-efficient.
October	13·54 to 16·45	....	83·40 to 93·8
November	13·14 to 17·33	....	81·34 to 92·9
December	11·82 to 18·37	....	81·40 to 95
January	10·6 to 14·78	....	76·81 to 92·76
February	8·82 to 14·16	....	———

The Bamboo has given the best results in various districts in which experiments were made. Recent analysis 1889-90 by same expert shows :—

Months.	Sugar variation.		Purity co-efficient.
July	7·64 to 17·3	....	78·42 to 95·68
August	6·53 to 18·81	....	82·30 to 93·22

It is not worth while for the present to give figures relating to density of juice; sufficient to remark, that the maximum is reached in July and August; it is then 1083, and the minimum during other months is 1033.

PROFITABLE LIME GROWING.

As many estate owners, particularly in Montserrat, Jamaica, and Dominica, are now turning their attention to growing limes, it will, no doubt, interest many of our readers to learn of a simple method of ensuring a ready sale for their product.

Hitherto lime juice has been generally sent home raw in puncheons, in which state it is sold at per gallon for making citric acid, and at very low prices, the present price being about a shilling per gallon. In small quantities, good marks fetch better prices for direct consumption; but the sale is often so slow that any expected profit is swallowed up in charges. Now concentrated lime juice sells readily on arrival at about £18 per puncheon, on the basis of 64 ozs. of citric acid per gallon 1·256 sp. gr.

On an estate in Dominica, where sugar cultivation has been replaced by lime growing, the limes are pressed through the sugar mill with the rolls set well apart, the juice being collected and distilled in an old rum still, and the oil separated from the juice in the distillate; the juice is then passed on the copper wall battery and concentrated in the copper teaches to about 85° citrometre=1,340 sp. gr. In Montserrat also it is customary to concentrate the juice in copper teaches, but in so doing there is great loss by carbonization, and the juice becomes loaded with copper, is of a very dark colour, and only fit for citric acid manufacture.

Messrs. James Shears and Sons, Engineers and Coppersmiths, of Bankside, London, a firm well-known all over the colonies for the excellence of their sugar machinery and distillation plant, have lately introduced a simple and effective method of concentrating lime juice by steam, which has found great favour with those who have given it a trial. The concentration is effected in vats by means of a special form of steam coil made of pure English block tin, and with ebonite fittings. With every set of four concentrators they supply, if required, a suitable steam boiler of a handy type. It is inexpensive, durable, and easily cleaned, and rapidly effects concentration to the highest degree citrometre, though it is advisable not to concentrate higher than 60° citrometre, as the loss by carbonization increases with the density. Such concentrated lime juice, being free from metallic influence, is pure and fit for edible purposes, and occupies in the ship's hold only about one-fifth of the freight-measurement required by raw juice. We should think small growers would find it worth their while to combine and establish central factories on this plan for their mutual benefit.

A further source of profit from limes is the extraction of the essential oil from the peel. In Montserrat women are employed to collect the oil, and are paid on a scale *pro rata* of the quantity procured.

A peculiar form of appliance is used for this purpose; it consists of a copper bowl about twelve inches diameter, studded all over inside with sharp-pointed copper pegs. The limes are rolled round on the points of the pegs, by which operation they become punctured, the oil exudes and runs down the pegs into the bowl, being afterwards poured out into a measure and weighed. This oil fetches from 2s. to 8s. per pound, and sells readily.

JAVA.

Experimental Stations for the Cane Sugar Industry in Java.

By H. Winter.

The recognition of the fact that both the cultivation of the cane and its manipulation in the manufacture of sugar were capable of manifold improvement, and that the assistance of science was indispensable in both operations, has already resulted in the founding of three experimental stations in different parts of the Island of Java. The whole of these are maintained from private sources without any assistance from the State, affording a fair proof of the readiness of the planters to make sacrifices for so desirable an end.

At the commencement of 1886 the statutory regulations for the stations of "Midden-Java" at Samàrang, and "West-Java" at Kagok, were approved, and the legal position of the institutions recognised by the Governor General of the Dutch East Indies. In the following year the station "Oost-Java" Pasoeròean (pronounced Pasooroo'an), was founded by the united action of the planters in the East of the island. The *personnel* of both the first-named institutions is German, while that of the last is Dutch. In Java the cultivation of the cane and its manufacture into sugar are not separated; the planter is also always a manufacturer, consequently the duties of the stations are not divided but at all of them both botanists and chemists are employed.

The "Midden-Java" Experimental Station is located at Samàrang, the third largest town in the island, situated on the north coast. It is maintained by 42 plantations and 7 large commercial houses, and at present possesses a good chemical laboratory and numerous arrangements for microscopic and botanical work. A bacteriological department is in course of establishment. A course of instruction for factory chemists, which is followed every year by some 10 students, is connected with the station, which supplies the laboratories of the sugar factories with apparatus and chemicals at a low price. Up to a short time ago it was under the direction of Dr. Soltwedel, who died in 1889 from syncope of the heart, and whose name has of late been frequently mentioned outside the island of Java, as the first discoverer of the seed of the sugar-cane. The issue of numerous small publications, all of them, however, in Dutch, gives proof of the active work carried on at the station. Unfortunately the extensive

range of experiments in the field with regard to cultivation and manuring has been interfered with by the outbreak of the Sereh disease, so that a large portion of the work has hitherto not been attended by results. Since April, 1890, the station has been under the direction of Dr. F. Benecke.

The co-operation of 24 factories and business houses resulted in the foundation of the "West-Java" station in the little village of Kagok, situated about 2 miles distant from the coast and the small town of Tegal. This is under the managemeut of Dr. Krüger, and is now supplied, though in a less degree than the station just mentioned, with all the appliances necessary for botanical and chemical labours. It possesses an oil-gas works, and a large stretch of land for experiments in the open country. The difficulties at this station have been especially great, as the two officials were the only white men in a district which was totally strange to them, and were dependent entirely on the help of a factory in the neighbourhood.

The "Oost-Java" station at Pasoeroean, a small town in the extreme east of the island, founded by 32 factories and 6 business houses is under the management of Dr. J. G. Kramers. The building is large, and its arrangements are fully equal to those of the sister institutions. In consequence of the efforts of some of the members, a course of instruction for factory chemists has lately been opened. The position is more favourable than those of the other stations, as Eastern Java possesses the greatest number of plantations, and was attacked by the devouring sereh disease later than the western side.

Since the founding of these Experimental Stations, the endeavour to improve the cultivation and manufacture has been very generally manifest, and it has been intensified by the fear of the consequences of the sereh disease. In most of the factories the beginnings of a laboratory are to be met with, three or four of them indeed possess laboratories which would do honour to any European factory, and are endeavouring to establish and maintain a regular control of their working on the European model.

Those employed as chemists, in the cases where they may be considered to deserve the name, frequently leave much to be desired, but their position as regards the managing body, mostly composed of planters, is a very difficult one.

Several newspapers devote a portion of their columns to the sugar cane.

DIFFUSION AND THE SACCHARINE RICHNESS OF THE CANE.

(From the *Courrier de la Guadeloupe.*)

Can diffusion be considered as an economical method of extraction, whatever may be the saccharine content of the cane to which the process is applied?

We shall confine ourselves in this paper to the examination of what is gained and what is lost up to the crystalisation of the sugar, whether the system applied is that of the mill or that of diffusion. These broad questions will have to be faced as soon as we have come to a conclusion as to the advantages of diffusion under given circumstances.

We will take the case of a factory dealing with 300 tons of cane per day, and working for 100 days.

Let us suppose that with a good mill, with a defibrator attached in front, it is possible to extract 75 kilos. out of 100 kilos. of juice contained in the cane.

It is known that by employing direct diffusion it is easy to extract the equivalent of 88 kilos. of the normal juice in the same 100 kilos.

The loss by the mill is then 13 kilos. of juice per 100 of cane. We have now two cases to examine:—

1st. Where the cane is poor.

2nd. Where the cane is rich.

Take the first case. The analysis of the normal juice gives a specific weight of 1,000, corresponding to 8° B. These indications show that the 100 kilos. of juice contain 11 kilos. of sugar, or that 100 kilos. of juice contain 12 k. 300 of crystallisable sugar.

Under these circumstances, the loss in sugar for the 13 kilos. of juice not extracted by the mill is

$$\frac{13 \times 12{\cdot}3}{100} = 1 \text{ K. } 59 \text{ per } 100 \text{ kilos. of cane.}$$

For the 200 tons in question, the loss will then be 2,000×1 K. 59, or 3,180 kilos. of sugar by weight.

Reckoning at 30 francs per 100 kilos. of sugar issuing from the boiling vat, we have a loss in sugar of 31·80×30f. or 954 francs per day, which makes for the whole of the campaign 95,400 francs.

At what cost has this excédent (sic) of yield been obtained?

The quantity of water in the 75 kilos. of juice extracted by the mill can be ascertained very nearly by deducting from these 75 kilos.

the quantity of sugar indicated by the analysis. As 100 kilos. of normal juice contain 12 K. 300 of sugar, then 75 kilos. would contain $\frac{12{\cdot}300 \times 75}{100} = 9$ K. 22. The quantity of water will then be found by 75—9·22=65·78. The diffusion juice resulting from the treatment of 100 kilos. of cane contains a quantity of water which may be estimated at 131 kilos. The excess of water to be evaporated in the case of diffusion will then be 131 k.—65·78=65·22. We see by this that the cost of evaporation will be doubled. In dealing with 200 tons of cane, we shall have to evaporate 2,000×65·22 or 13044, kilos. of water. But the evaporation of 10 kilos. of water involves the consumption of 1 kilo. of coal. The 130·440 tons of water to be evaporated will then require 13·044 tons of coal. Reckoning the ton of coal at 45 francs at the works, we shall have a daily supplementary expenditure for evaporation amounting to 13·044×45=586 fr. 98.

	Francs.
This means for the entire campaign	58,698
On the other hand, by crushing the cane in the mill, we get 25% of bagasse, equal to 50 tons per diem, and 5,000 tons for the whole campaign.	
Reckoning at 13 francs the value of a ton of bagasse, the loss by substituting diffusion for milling will have been 5,000 × 13, or	65,000
The expenses or losses attaching to the use of diffusion will then be in this case	123,698
The extra value of the yield in sugar by the diffusion process being in the same case	95,000
The gain by the extraction by the mill would therefore be	28,698

Before proceeding to consider the second case, we shall have to say a few words with regard to the value of the diffusion chips. In making a calculation as to their worth as fuel, we shall have to look to the expenses caused by drying or dessicating it. It is useless to think of drying it by exposing it to the rays of the sun. In Guadeloupe the frequent showers of rain would render this operation quite impracticable under ordinary conditions. The drying can only be effected by double pressure, hence it becomes necessary to set up two powerful mills.

The cost of purchase of these two mills, with the engines to drive them, and the cost of erection, cannot be reckoned at less than 80,000 francs. The maintenance and sinking fund for this plant will involve an annual charge on the budget of the works of 8,000 francs.

	Francs.
This is equal for each working day to..................	80·00
The consumption of coal for driving the mills, reckoning 1 k.500 of coal per horse power and per hour with a total of 60 h-p. will be 1 k.500 × 24 × 60 = 2,160 kilos. At 45 francs per ton this means an outlay for coal of 2,160 × 45	97·20
The tending of the two engines requires four drivers and four assistants = 8 at 3·50 fr.	28·00
The personnel for each station and each mill could not be less than six in each case, or a total of 24 at 2·50 fr...	60·00
This gives a daily total outlay of	265·20

For this sum we get 35 tons of chips with 45 to 50% of water.

The cost price of a ton of chip fuel is then $\frac{265}{35} = 7{\cdot}57$ francs.

Can we consider a fuel so powdery and bulky as worth more than its cost price? We think not.

By drying we are thus able to get rid of a bulky waste product, difficult to handle, but we do not add anything to the credit side of the diffusion calculation.

We will now take the second case. The analysis of the normal juice gives a specific weight of 1,083, corresponding to 11° B.

From these indications we calculate that 100 kilos. of normal juice contain 20 kilos. of sugar, and that the cane from which it is obtained has a saccharine content of 18%.

The gain by diffusion will be $\frac{13 \times 20}{100} = 2\text{k}.600$ per 100 kilos. of cane, or a gain per diem of 2k.6 × 2,000 = 52,000 kilos. At the price of 30 fr. per 100 kilos. of sugar this is equivalent to a profit of 52 × 30 = 1,560 fr. per diem. This means for the entire campaign an extra receipt of 156,000 fr.

Deducting from this result the supplementary cost of evaporation and the loss of the bagasse, which are the same in both cases, and which we have calculated at 123,698 francs, we have an excess in the receipts, in the case of diffusion, of 156,800 francs—123,698 francs = 32,302 francs.

We see, then, that we arrive at very different results when the cane is poor and when it is rich.

	Francs.
On the one hand, with poor cane, we have with the mill, with the defibrator attached, a saving of	28,100
On the other hand, with rich cane, we have by diffusion a gain which amounts to an annual extra receipt of......	32,302
Thus, between loss and gain, when the cane is of 11% and 18% saccharine content, the employment of diffusion gives a difference of	60,402

So that in any case if the diffusion process of extraction should be adopted, we should need to be able to reckon the sugar, before being turbined, as worth 40 francs per 100 kilos.

Supposing that *excédents de production* were granted as in the case of beet sugar, could we hope to bring the value of the sugar contained in the massecuite to this price?

A reduction in the price of fuel would enable us to apply diffusion to canes of no great saccharine content. But we must not exaggerate the importance of this reduction. On the hypothesis we have assumed, a reduction of 10 francs per ton, which is enormous, is equivalent to a diminution of 13,000 francs in the cost of evaporation, leaving still to the credit of the mill process, in the first of the cases examined, an amount of 15,000 francs.

From the above considerations it seems that we may conclude:—
1st. That diffusion should be employed wherever the cultivation employed will justify us in expecting canes of a high saccharine content.

2ndly. That is illusory to reckon on diffusion for obtaining, in the case of poor canes, a yield sufficient to make up for the low price of sugar.

If we cannot consider diffusion as in all cases advisable, is it the same with diffusion of bagasse which has previously passed through the mill? The consideration of this question would carry us beyond the limits which we have fixed for our examination. But we can easily see that with this method we should not lose more sugar than by direct diffusion. On the one hand the bagasse resulting from diffusion will be totally different in its nature from the diffusion chips and almost equal in value, as regards heating power, to the bagasse obtained from the same weight of canes by the milling process.

In making a short enquiry into diffusion applied to bagasse, we should have to suppose—1st. A factory possessing a mill which would give by simple crushing 60 kilos. of juice per 100 kilos. of canes and 40 kilos. of bagasse which would be treated specially in a diffusion battery.

2ndly. Another factory having two powerful mills, with a defibrator attached, in which the same quantity of canes as in the preceding case and having the same saccharine content would be worked up.

The comparison of the advantages and disadvantages of the two methods would result, I believe, in proving that whatever the richness of the cane, the first factory will have a marked advantage over the second.

Correspondence.

TO THE EDITOR OF "THE SUGAR CANE."

Sir,—In your December number an interesting article, dealing with the comparative merits of double crushing and diffusion, appears from the pen of Mr. J. N. S. Williams.

This article, which is based upon operations carried on in Honolulu, is a reply, from a diffusion point of view, to Mr. Nevile Lubbock's paper on the subject in *Timehri*, and the writer gives figures which show decidedly in favour of diffusion.

Unfortunately, however, for the validity of the conclusions at which Mr. Williams has arrived, in calculating the extra percentage of sugar extracted from the cane by diffusion over that by double crushing, he has entirely overlooked the fact that the proportion of cane sugars in the juice left in the megass from crushing is not so great as in the juice expressed. In other words, the 72% crushing which Mr. Williams takes as the mill work would *not* represent merely $\frac{100 \times 72}{89} = 80{\cdot}9\%$ of the sugar in the cane, but a higher proportion than this.

As a matter of experience, with canes containing the 11% fibre which Mr. Williams mentions, 72% of dry mill crushing would mean 86% of the total cane sugar in the cane as being expressed in the juice.

The increment due to diffusion is therefore 10% on 86 or 11·6%, as against the 18·7% which Mr. Williams uses as the basis of the comparison.

Recalculating, therefore, the figures for this modified increment, but using Mr. Williams' data and method of comparison, $14,355 which he claims to the credit of diffusion dwindles to $4,106.

It must also be borne in mind that in the article in question only 6·8 cwt. of coal are reckoned as consumed per ton of diffusion sugar, a figure which all advocates for diffusion will admit is exceptionally low when moist chips are used as fuel.

Mr. Williams only puts down the cost of installation of a diffusion plant to turn out 20 tons sugar per diem as $50,000. Surely this does not include the extra evaporating power required?

I am afraid that Mr. Williams' paper, interesting as it is, does not go far towards settling the vexed question of mill *v.* diffusion. With low fuel, low labour, and cheap installation, the only profit which his figures can show amounts to but $4,000, a sum hardly sufficient to warrant the adoption of a process in which so many points of uncertainty exist.

Faithfully yours,

Demerara, December 31st, 1890. FREDERIC J. SCARD.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. THOMPSON, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; Angel Row, Nottingham; and 323, High Holborn, London.

ENGLISH.

APPLICATIONS.

17521. C. E. HALL, Sheffield. *Improvements in crushing machines.* 1st November, 1890.

17557. A. WOHL and A. KOLLREPP, London. *Improvements in production of invert sugar.* 1st November, 1890.

17955. H. H. LAKE, London. (Communicated by Sangerhäuser Actien Maschinenfabrik and Eisengiesserei, vorm. Hornung and Rabe, and Ernest Schulze, Germany.) *Improvements in slicing machines for sugar cane and the like.* (Complete Specification.) 7th November, 1890.

18050. THOMAS THORP, Whitefield, Lancashire. *A new and improved apparatus for the clarifying of liquids.* 10th November, 1890.

18751. OTTO SCHULZ, 70, Market Street, Manchester. *Improvements in continuous evaporating apparatus.* 29th November, 1890.

18810. JAMES J. JOHNSON, London. (Communicated by Paul Ribard, France.) *Improvements in filter presses.* 20th November, 1890.

20024. THOMAS W. NEWEY, Birmingham. *Improvements in sugar crushers.* 9th December, 1890.

20181. HUGH MACMILLAN, Glasgow. *Improvements in apparatus for evaporating, concentrating, or distilling saccharine liquids or such like.* 10th December, 1890.

21066. A. BOABE and F. G. A. ROBERTS, London. *An improvement in the manufacture of caramel.* 24th December, 1890.

21101. F. W. TOMPSON, London. *An improvement in the manufacture of invert sugars.* 27th December, 1890.

249. H. E. RYCROFT and A. MASON, London. *An improved process of, and apparatus for, distilling and refining petroleum and other hydrocarbons; applicable also for distilling and refining animal, vegetable, and fruit oils, saccharine juices, syrups, essential oils, and other substances.* (Complete Specification.) 6th January, 1891.

534. L. A. Philippe, London. *Improvements in filtering apparatus.* 10th January, 1891.

ABRIDGMENTS.

11686. 1890. Samuel M. Lillie, of Fourth and Chestnut streets, Philadelphia, Pennsylvania, United States, America. *Improvements in evaporating apparatus.* Date of application, July 25th, 1890. Date claimed under International Convention, December 26th, 1889. This invention relates to in transit evaporators. A series of tubes are arranged horizontally in an air-tight casing, and the liquor under treatment is caused (by means of a circulating pump) to flow over them, whilst steam is passed into them. A double effect apparatus is shown, though the invention is not limited to that form. One of the advantages of the apparatus is that stagnant air and gas may readily be removed.

14736. 1889. G. F. Redfern, of 4, South Street, Finsbury, Patent Agent. (A communication from W. P. Abell, of L'Union, Essequebo, British Guinea.) *Improvements relating to centrifugal machines.*) Dated September 18th, 1889. A series of baskets, each of which is capable of revolving upon its own centre, is arranged around a central spindle. In the bottom of each of the baskets is a central opening, above which is supported a downwardly depending cone. The masse-cuite is fed from a hopper into the said cones, and is driven by centrifugal force over their edges into the surrounding baskets, which are all revolved together around the central shaft, and at the same time independently on their own spindles. At a certain point the mass flies on to the cones, and from there falls into a hopper beneath.

13555. 1889. R. Raeymaeckers, of Sirlemont, Belgium, engineer. *An improved process and apparatus for the concentration of saccharine and other liquids and obtaining crystals therefrom.* August 27th, 1889. A series of vertical vessels is provided, each communicating with a reservoir of syrup. A certain quantity of syrup is placed in the first vessel and heated, and when the formation of crystals has commenced, fresh syrup is admitted to the same. The syrup is passed into the next vessel and treated as before, its purity decreasing from vessel to vessel. Perforated plates retain the crystals in each vessel.

3589. 1890. Carl Steffen, of 40, Hengrasse, Vienna. *Improved process for the manufacture of sugar.* Dated, March 6th, 1890. The

object of the invention is to obtain the whole amount of sugar from juice. The syrup used as lixiviating fluid is washed out of the mass of crystals by means of water, steam, or pure sugar solution. Several diagrams of curves are shown.

4754. 1890. A. J. BOULT, of 323, High Holborn, London. (Communicated by Leopold Bon, of Guantanamo, Cuba, manufacturer.) *Improvements in or relating to apparatus for drying sugar-cane to ash.* March 26th, 1890. This invention relates to apparatus whereby sugar-cane trash may be rapidly dried, and thus made available for use as fuel. A tray, upon which the trash is placed, reciprocates in a tunnel through which the hot furnace gases are led. A series of pivotted teeth or fingers rest upon said tray in such a manner as to cause the trash to be moved along from end to end of said tray, and thus be passed through the furnace.

9045. CECIL W. FISHER, of 45, Holborn Viaduct, London. (Communicated by A. LEBLANC, of Havana, Cuba, engineer.) *New and useful improvements in sugar cane mills.* Dated September 3, 1890. These are improvements on Patent No. 16395 (1888), and are divided into three heads. The first consists in encircling the feed and receiving rollers and the box or conduit by one or more rings or hoops to prevent them from being pulled apart. The remaining improvements relate to the said box, with reference to the shape of the orifices therein, and the employment of a pump in condition therewith.

12635. HENRY H. LAKE, of London. (Communicated by Dr. L. Sternberg, of Stapleton, New York, chemist.) Dated August 12, 1890. The object of this invention is to get rid of the glucose in saccharine solutions as a preliminary step to the extraction of the crystallisable sugar. The details of the operation may be varied, but as an example, to a boiling solution (20%) of sugar 30% of quick lime or hydrate of lime is added, and the boiling continued for about two hours. After treatment in a filter press the solution is "blown up" by means of carbonic acid and again filtered. The noxious compounds of glucose are thus removed.

13810. JOHN LAIDLAW, of 98, Dundas Street, Kingston, Glasgow, N.B. *Improvements in centrifugal machines.* Dated September 3rd, 1890. Self-balancing baskets supported from below. The basket is suspended upon the top of a vertical spindle which rises up a cone-shaped recess therein. Radial pivoted arms upon the spindle fly

outwards when the latter is revolved, and cause the basket also to revolve by friction. The arms, being loosely pivoted, allow the basket to turn so as to revolve about its true centre of gravity.

17938. J. G. Chamberlain, of Tipton, Staffordshire, Manufacturer, and G. E. Davis, of 301, Great Clowes Street, Manchester, Lancashire, Chemical Engineer. *For improvements in apparatus for the evaporation of liquids.* Dated November 11th, 1889. A double-effect apparatus is shown in the drawings. The chief points of novelty appear to be the use of a water jet for maintaining vacuum and withdrawing the vapours, and the employment of a depending pipe ("tail pipe") to remove the concentrated liquor. This pipe is of sufficient length to draw out the liquid in opposition to the vacuum. A liquid seal closes the lower end of the tail pipe.

20784. R. A. Robertson and W. J. Mirrlees, of 45, Scotland Street, Glasgow, Lanarkshire, N.B., Engineers. *For improvements relating to apparatus for evaporating, concentrating, and distilling liquids.* Dated December 27th, 1889. This relates to multiple effect apparatus, and the improvement consists in so arranging said apparatus that the liquor is first fed into that vessel whose temperature is lowest and passes through the series, and is finally removed from the hottest vessel. This is the reverse of the usual proceeding.

AMERICAN.

ABRIDGMENTS.

435784. James J. Adams, of Cienfuegos, Cuba, and Lewis W. Tracey, of New York, assignors to said Tracey and James E. Granniss, of New York. *Apparatus for the treatment of cane juice.* September 2nd, 1890. This invention relates to in transit evaporators, and the purpose of the invention is to provide an improved apparatus, to render it lighter and consequently cheaper to manufacture, handle, and erect, than those hitherto used, and to economically improve the results obtained. A series of tubes is arranged in a closed chamber, and the liquor under treatment is caused to flow over the outer surfaces thereof whilst steam or other heating medium is passed through them. Suitable traps and feed and discharge openings are provided.

438266. Henry S. Firman, of Chicago, Illinois. *Vacuum evaporating apparatus.* The apparatus comprises a horizontal steam jacketted chamber presumably cylindrical, and having a dome at top, from which the vacuum pipe is led. Connected with the dome is a

smaller secondary chamber, which may be used for several purposes such as overflow traps, or as preliminary heater. A series of agitating arms, composed of metal piping, are attached radially to a central hollow shaft, which may be heated by steam or otherwise. The apparatus is intended for use in treating various kinds of material such as sugar-cane, blood, paints, etc. Dated October 14th, 1890.

438787. GEORGE E. WHEELER, of Chagy, New York. *Process of evaporating maple sap, or other fluids.* A shallow evaporating pan is provided, with a cover and a chimney leading therefrom, and both chimney and cover are insulated by means of cork, or air spaces. A series of minute holes are arranged in the pan lid or the pan itself, and these holes allow air in fine streams to enter the pan and strengthen the draught. The heat for evaporating may be applied in any suitable way. Dated October 21st, 1890.

440231. S. M. LILLIE, of Philadelphia, Pen., U.S.A., Assignor to the Sugar Apparatus Manufacturing Company, of same place. *For evaporating apparatus.* Dated November 11th, 1890. This invention relates to "in-transit" evaporation. The liquor is fed through an upper perforated plate on to a series of horizontal tubes, each of which is closed at one end and connected at the other with a steam supply. Means are provided for the escape of the stagnant gases which lodge in the tubes. Details of construction are described *in extenso*.

440747. JOHN PATTEN, of New York, N.Y., Assignor to the John Patten Manufacturing Company, of same place. *Vacuum Chamber.* Dated November 18th, 1890. The vacuum chamber is constructed of brick, covered and made air-tight with paint or the like, and is supported on a foundation of cement. A suitable impervious shield is placed between the chamber and its foundation. The liquid to be treated is contained in an inner vessel, which being exposed to equal pressure within and without need not be of any great thickness. By this invention it is practicable to construct, at comparatively small expense, vacuum chambers far larger than any hitherto made.

441001. W. S. GILMORE, of Chester Cross Roads, O., U.S.A. *Evaporating pan and furnace for operating the same.* November 18th, 1890. The furnace is located at one end of the apparatus, and is provided with a long open-topped combustion chamber, upon which a series of open evaporating pans is adapted to be placed. Each pan is provided with mid-feathers and tubular connections, so that the juice,

&c., under treatment may circulate in each pan and then pass on to the next. The pans are also provided with heating tubes, which, when used, form return flues for the products of combustion, and in other cases are inactive, the change being effected by means of movable baffles or dampers. One, two, or more pans may be used at a time, the hot gases being directed as required.

441076. CARL STEFFEN, of Vienna, Austria-Hungary. *Apparatus for producing white sugar.* November 18th, 1890. This is an apparatus whereby raw sugar may be washed with sugar solution, and so purified white in the mould ; and the invention comprises the arrangement and grouping of the moulds into a lixiviating battery in such manner that the purifying solution may be passed through all the sets of moulds in series. When the contents of one set is sufficiently purified (which was the first to receive the liquor) is replaced by another, which becomes the last. Details are given.

441106. M. M. MONSANTO, of Holboken, N.J., assignor to the National Salt and Chemical Co. *Apparatus for the vaporization of liquids.* Dated November 18, 1890. In this apparatus a spray of the liquid to be vaporized (concentrated) is caused to fall down an annuler space in a tower, while a stream of hot air, purified combustion gases, or sulphurous oxide, ascends, and meeting said spray absorbs and carries off the superfluous moisture therefrom.

GERMAN.

ABRIDGMENTS.

52885. C. PÖLEKE, Ballenstedt aa Harz. *Process for the recovery of ammonia in the form of salts of ammonia from saccharine juices.* 28th September, 1889. The process consists in treating the uncondensed steam or fumes from the boilings, before it reaches the heating chamber of the evaporating apparatus, with acids in a gaseous form or in the form of liquid spray.

52915. G. A. HAGEMANN, Copenhagen. *A centrifugal froth damper.* 8th February, 1890. The new arrangement consists of a rapidly rotating wheel which is placed above the frothy liquid, and throws the froth by centrifugal power against the sides of the vessel which causes the liquid particles to separate, and the gases are thus liberated. This new arrangement is intended especially for the saturation vessels of sugar works, for on the introduction of carbonic acid, a great quantity of froth is produced.

52975. G. OLBERG, Grevenbroich. *Evaporating and distilling apparatus.* 3rd May, 1889. Heating and evaporating or distilling chambers are alternately formed by placing rows of plates, ribbed or otherwise, one on top of the other, and fastening them together. Adjustable injection openings are connected with these chambers. A pipe which serves as the common outlet for all these chambers is provided with an air diluting apparatus. This pipe can, if desired, be provided with partition walls. The aim of the invention is to conduct the liquid to be distilled or evaporated in the form of vapour or spray into the evaporating chambers, while at the same time bringing these chambers under the action of heat and vacuum, the vaporised products and the liquid products being each discharged through separate openings.

52065. ADALBERT MEDEK and GUSTAV TAMM, Klinzz, Russia. *Improved knife box for shredding machines.* 9th August, 1889. A movable roller composed of separate shredding cylinders is fixed in front of the shredding knife. The narrow openings in the apparatus can thus be penetrated in a perpendicular manner by the aforementioned cylinders.

52762. EDMUND SELLSCHOPP, Lupendorf, nr. Schwinkendorf, Mecklenburg-Schwerin. *Improved apparatus for testing beetroot and the like.* 4th December, 1889. The wagon laden with the roots is placed under the apparatus, and the cylinder provided with the cutters screwed down into the load. By this means a sample of the roots can easily be obtained, and the quality of the load can thus be readily estimated.

52913. FIRMA CARL SPAETER, Coblenz. Addition to Patent No. 39134, dated October 4, 1885. *Improved process applicable to the purification of sugar solutions, juice of plants, and the like, by the aid of hydrate of magnesia.* 9th January, 1890. The carbonate of magnesium mentioned in the principal patent is replaced by bicarbonate of magnesium, the magnesia, which is added to the sugar solution in the form of carbonate or oxide, being by the introduction of carbonic acid dissolved into bicarbonate of magnesium. This process is also recommended for the purification of the juice of plants, glycerine, and the like.

53021. FR. RASSMUS, Magdeburg. *A double shredding knife.* 6th February, 1889. This knife consists of two knives joined together by soldering, rivetting, or the like, so that the shreddings produced

by the lower knife are discharged through the opening formed between the receiver and this lower knife, while the shreddings separated by the upper knife are discharged through the channels formed between the upper surface of the lower and the under surface of the upper knife.

53380. ADAM WEBER, New York. *Bone-black furnace.* 31st July, 1889. Underneath the retorts, which have a common foundation, are placed the coolers, out of which the charcoal is periodically discharged through a sliding door. By the aid of a worm it is then conveyed to a comminuting apparatus. The top of each retort is divided into two, the one division serving for the discharge of the distillation gasses, the other for the introduction of the bones.

53679. CHRISTIAN ANDREAS FREITAG, Amsterdam. *Apparatus suitable for aiding the circulation of the masse cuite in vacuum apparatus.* 3rd April, 1890. In order to further the circulation of the masse cuite during the boiling process, a stationary central pipe, within which a movable pipe is fixed, is arranged in the apparatus, together with a jacket fixed in the side of the apparatus.

53043. Julius Schwager, Berlin. *Surface evaporator.* August 23rd, 1889. The impermeable to liquid heating pipes, inserted above and below, and heated from the interior of the apparatus, intersect a space which is reserved for the introduction of the liquid to be evaporated. The bottom of this space encircling the pipes is provided with openings, the diameter of which is larger than the external diameter of the heating pipes, so that the thin coating which forms on the liquid is discharged through these pipes, and in consequence of there being just sufficient steam expansion necessary for the evaporation, an increase in the quantity of steam evolved takes place. For the purpose of regulating the cross section of the openings through which the liquid flows, nozzles are fixed to each pipe, the latter can be raised or lowered by means of a closing piece, common to all. A plate is also provided with openings for the purpose of permitting thin streams of the liquid in process of evaporation to be discharged. These openings are of use when the pipes are heated from the interior as well as in the case of heating through the external case of the apparatus.

52910. JOHN E. SEARLES, junior, Brooklyn, New York, United States, America. *Process and apparatus for pressing and lixiviating sugar cane, beet root, and the like.* November 27th, 1889. The

substance to be pressed is delivered from a piston to a counter opposed fluid, which is under pressure, in such a way that this latter is forced to penetrate through a heaped up mass of the material, which is periodically renewed, and so simultaneously with the necessary back pressure a lixiviating action is obtained. The lixiviated juice is discharged through openings fixed in front of the piston. The apparatus consists of a pressure cylinder, a receiver under hydrostatic pressure for the counter current fluid (generally water), a funnel, a crank-actuated piston, and a chain pump, which removes the sugar cane from the liquid.

53679. CHRISTIAN A. FREITAG, Amsterdam. *Improved apparatus applicable for effecting the circulation of the masse cuite in vacuum apparatus.* 3rd April, 1890. In order to bring about the circulation of the masse cuite during the boiling process, a pipe is fixed in the centre of the apparatus within which a smaller one moves, likewise a jacket, forming a circular isolated chamber on the side of the apparatus.

53644. GEORGE PAULICK, Leipzig. *Cylindrical knife-box for root-cutting machines.* 6th March, 1890. In order, by the action of centrifugal power, to force the roots against the knife-cutter, the knife-boxes are arranged in an ascending slope to the outside.

53313. CARL STEFFEN, Vienna, and RAYMOND RAEYMAECKERS, Tirlemont, Belgium. *Suction battery applicable for the production of white sugar from the raw material.* 18th May, 1889. (Addition to Patent No. 31486. 1st June, 1884.) The apparatus consists of several groups of sugar loaf shapes, which groups are connected together in such a way by conducting and discharge pipes, through which the casing syrup flows, that this latter penetrates the sugar placed in the groups afore-mentioned, and thus the sugar is systematically purified from the molasses adhering to it. As the conducting pipes are connected with both the last and first group of moulds, a complete circular process, similar to that produced in a diffusion battery, takes place.

WEEKLY STATEMENT OF COMPARATIVE

For the Fifty-two Weeks,

	German Beetroot 88 o/o Prompt, free on board.						French Crystals. No. 3. c. f. i.			West India. Good Brown.			Java afloat. No. 15 and 16.		
	1890.		1889.		1888.		1890.	1889.	1888.	1890.	1889.	1888.	1890.	1889.	1888.
Jan. 3..	11/7½	11/6	13/9	13/10½	15/9	16/-	13/6	16/6	18/6	11/9	13/6	15/-	15/-	17/1½	17/6
10..	11/6		13/9	13/10½	15/6	15/4½	13/7½	16/6	18/3	11/9	13/6	14/6	15/-	17/-	17/3
17..	11/6	11/7½	13/7½		14/10½		13/9	16/3	17/6	11/9	13/6	14/-	14/9	16/9	16/-
24..	11/7½	11/9	13/7½	13/9	14/6	14/7½	13/10½	16/1½	17/3	11/9	13/6	14/-	14/6	16/3	16/4½
31..	11/7½	11/9	13/6	13/7½	14/6	14/10½	14/-	16/1½	17/-	11/9	13/6	13/9	14/9	16/4½	16/4½
Feb. 7..	11/7½	11/9	13/9	13/10½	14/7½		14/3	16/4½	16/9	11/9	13/6	13/6	14/9	16/4½	15/9
14..	12/1½	12/3	13/10½		13/10½	14/1½	14/9	16/7½	16/3	12/3	13/6	13/-	15/-	16/4½	15/3
21..	12/1½	12/3	14/-	14/1½	14/4½	14/6	14/10½	16/9	16/4½	12/3	13/9	13/-	15/-	16/6	15/9
28..	12/4½	12/6	14/3	14/4½	14/6	14/7½	15/1½	17/-	16/6	12/6	14/-	13/-	15/-	16/7½	15/9
March 7..	12/6	12/3	14/10½	14/7½	14/4½	14/6	14/9	17/6	16/6	12/6	14/6	12/9	15/-	17/-	15/9
14..	12/3	12/4½	15/-	15/3	14/4½	14/7½	15/-	17/9	16/9	12/6	14/9	13/-	15/-	17/3	15/6
21..	12/4½	12/3	15/6	15/9	14/4½		14/10½	18/6	16/9	12/6	15/3	13/-	14/10½	17/9	15/9
28..	12/3	12/-	17/3	17/4½	14/1½	14/-	14/9	19/6	16/9	12/6	16/-	13/-	14/9	18/9	15/7½
April 4..	11/10½		17/3	17/6	13/9	13/10½	14/9	19/9	16/9	12/6	16/3	12/9	14/9	19/-	15/7½
11..	12/-		18/6	19/3	14/1½	13/10½	13/10½	20/6	16/9	12/6	17/-	12/9	14/9	20/-	15/7½
18..	12/3	12/4½	21/3	21/6	13/7½	13/6	15/1½	22/6	16/9	12/9	18/-	12/9	15/-	22/6	15/6
25..	12/3	12/4½	23/7½	23/4½	13/3	13/4½	15/-	24/-	16/6	12/9	19/-	12/6	15/-	24/-	15/7½
May 2..	12/4½	12/6	21/4½	23/3	13/-	13/3	15/1½	23/-	16/6	12/9	18/-	11/9	14/10½	23/6	15/6
9..	12/6		20/4½	21/6	12/9	13/1½	15/1½	21/6	16/4½	12/9	18/-	12/-	15/1½	23/-	15/4½
16..	12/4½	12/6	21/-	22/-	13/-	12/9	15/-	23/-	16/4½	12/6	18/6	11/9	15/-	23/3	15/4½
23..	12/4½	12/6	22/-	22/9	13/-	13/1½	14/7½	23/3	16/4½	12/6	18/9	11/9	14/9	22/-	15/4½
30..	12/3	12/4½	21/3	23/6	12/10½	13/-	14/9	23/9	16/4½	12/6	19/-	11/9	14/7½	23/3	15/4½
June 6..	12/3	12/4½	22/3	24/6	13/1½	13/4½	14/9	24/6	16/6	12/6	19/-	11/9	14/7½	23/6	15/7½
13..	12/3	12/4½	23/-	25/9	13/9	13/6	14/7½	25/3	16/9	12/6	19/3	12/-	14/7½	25/-	15/7½
20..	12/3	12/4½	24/-	26/3	13/9		14/9	25/-	16/9	12/6	19/6	12/-	14/6	25/-	15/7½
27..	12/3	12/4½	25/-	28/3	13/10½		14/10½	25/9	17/-	12/6	20/-	12/3	14/6	25/-	15/10½
July 4..	12/3	12/4½	27/-	27/6	14/-		15/1½	26/-	17/-	12/6	19/6	12/3	14/7½	25/-	15/10½
11..	12/6	12/7½	19/3	20/6	14/7½	14/6	15/4½	24/-	17/-	12/9	19/-	12/3	14/9	24/-	16/-
18..	12/9	13/-	23/-	21/6	14/6		15/1½	23/9	17/-	12/9	18/6	12/3	14/9	23/-	16/-
25..	13/6	13/9	20/-	21/3	14/-		15/7½	22/6	17/-	13/-	18/-	12/-	15/3	22/6	15/9
Aug. 1..	13/6	13/9	19/9	19/6	13/10½		15/6	21/9	17/-	13/-	17/6	12/-	15/-	22/-	15/9
8..	14/-	14/3	19/-	19/3	13/10½	14/3	15/9	21/-	17/3	13/-	17/3	12/3	15/3	22/-	16/-
15..	14/3	14/-	18/7½		14/1½	14/3	—	20/6	17/3	13/-	17/-	12/6	15/3	21/9	16/1½
22..	13/9	13/6	16/-		14/4½		15/9	19/9	17/3	12/9	15/6	12/9	15/3	19/3	16/3
29..	14/-	13/9	15/-	14/6	14/7½	14/4½	16/3	19/3	17/3	13/-	14/6	12/9	15/9	18/-	16/3
Sept. 5..	14/-	13/10½	13/6	13/10½	14/3	14/7½	16/4½	18/-	17/3	13/-	13/6	12/9	15/9	16/9	16/3
12..	13/10½		14/3	14/7½	14/6	14/7½	16/6	17/3	17/-	13/-	14/-	12/9	15/9	17/-	16/3
19..	14/1½	13/9	14/-		14/9	15/-	16/-	17/-	16/9	12/9	14/-	12/9	15/6	17/-	16/6
26..	13/6	13/3	13/-	13/1½	14/6	14/-	15/9	16/-	16/3	12/9	13/6	12/9	15/6	16/-	16/6
Oct. 3..	12/9	12/7½	12/4½	12/7½	13/6		15/3	15/3	15/9	12/9	13/-	12/6	15/6	15/6	16/-
10..	12/10½	13/1½	11/10½		13/3		15/-	14/-	15/6	12/9	13/-	12/6	15/6	15/-	16/-
17..	12/10½	13/-	11/6		13/3	13/6	15/6	13/10½	15/9	12/6	12/-	12/6	15/6	14/6	16/-
24..	12/10½	13/-	11/1½	11/4½	13/3	13/1½	15/6	13/6	15/9	12/6	11/-	12/6	15/6	14/3	16/-
31..	12/10½	12/6¾	11/3	11/9	12/9	12/6	15/3	13/7½	15/9	12/3	11/-	12/6	15/6	14/3	16/-
Nov. 7..	12/6		11/7½	11/9	12/9	13/-	14/10½	13/9	15/9	12/-	11/-	12/6	15/3	14/6	16/-
14..	12/7½	12/6	11/10½	11/6	13/4½	13/3	14/9	13/10½	15/9	11/9	11/-	12/9	15/-	14/3	16/6
21..	12/6	12/3	11/6		13/6	13/7½	14/7½	13/6	16/-	11/9	11/3	13/-	15/-	14/3	17/-
28..	12/3	12/6	12/1½	12/-	13/3	13/6	14/9	14/-	16/1½	11/9	11/6	13/3	14/10½	14/9	17/-
Dec. 5..	12/4½	12/6	12/-	12/1½	14/3	14/4½	14/10½	14/-	16/9	11/9	11/6	13/6	14/10½	15/3	17/-
12..	12/4½	12/6	12/-	12/7½	13/10½	14/1½	14/9	13/9	16/6	11/9	11/6	13/6	14/10½	15/6	17/-
19..	12/4½		11/7½	11/9	13/9	14/-	14/9	13/9	16/4½	11/9	11/9	13/6	14/10½	15/3	17/-
26..	12/4½	12/6	11/7½		13/10½		15/-	13/7½	16/4½	11/9	11/9	13/6	15/-	15/3	17/-

PRICES OF RAW AND REFINED SUGAR

January to December, 1890-89-88.

	Tate's Cubes.			Martineau's Titlers.			Say's Loaves, f.o.b.			Lebaudy Loaves, f.o.b.		
	1890.	1889.	1888.	1890.	1889.	1888.	1890.	1889.	1888.	1890.	1889.	1888.
Jan. 3..	20/-	21/6	22/3	18/6	19/6	21/-	16/6	18/3	19/9	—	18/-	19/6
10..	20/-	21/6	22/-	18/6	19/6	20/9 21/-	16/3	18/3	19/6	—	17/9	19/6
17..	20/-	21/6	21/6	18/6	19/3 19/6	20/6	16/3	18/-	19/-	—	—	19/-
24..	20/-	21/6	21/6	18/6	19/3	20/- 20/3	16/6	18/-	—	—	17/6	18/6
31..	20/-	21/6	21/3	18/3	19/3	20/-	16/6	18/-	18/3	—	17/4½	—
Feb. 7..	19/6	21/6	21/-	18/-	19/3	19/6 19/9	16/6	18/-	18/-	—	17/6	17/9
14..	20/3	21/6	20/9	18/3	19/3	19/- 19/3	16/9	18/-	17/3	—	17/6	17/3
21..	20/-	21/-	20/9	18/3	19/3	19/- 19/3	16/9	18/-	17/9	—	17/6	17/4½
28..	20/3	21/-	20/9	18/6	19/-	19/3	16/9	18/6	18/6	—	17/9	17/7½
March 7..	20/3	21/9	20/9	18/6	20/-	19/3	16/9	19/-	18/-	—	18/4½	—
14..	20/-	21/9	20/6	18/6	20/-	19/-	16/9	19/-	—	—	18/6	—
21..	19/6	22/3	20/6	18/3	20/6	19/3	16/6	19/6	18/-	—	—	—
28..	19/6	23/3	20/6	18/-	21/3	19/3	16/6	20/6	17/9	—	—	—
April 4..	19/9	23/6	19/-	18/-	22/-	19/3	16/6	20/9	17/6	—	—	—
11..	19/9	24/9	20/6	18/-	23/3	19/3	16/6	21/-	17/6	—	21/-	—
18..	20/3	26/-	20/6	18/-	25/-	19/3	16/6	24/3	17/9	—	24/3	17/6
25..	20/-	27/6	20/9	18/-	26/-	19/6	16/6	24/9	17/6	16/3	—	—
May 2..	20/3	27/6	20/9	18/-	25/9	19/3	16/9	24/9	17/6	—	—	17/3
9..	20/-	27/-	20/6	18/3	25/-	19/- 19/3	16/9	24/-	17/6	—	23/-	17/3
16..	20/-	26/-	20/6	18/-	25/-	19/- 19/3	16/3	23/9	17/6	15/9	—	17/3
23..	19/6	26/-	20/6	18/-	25/9	19/- 19/3	16/3	24/-	17/6	—	—	17/3
30..	19/6	26/3	20/6	18/-	26/-	19/- 19/3	16/-	24/-	17/9	15/6	—	17/4½
June 6..	19/6	26/9	20/6	18/-	27/-	19/6 19/9	15/9	24/-	17/9	15/3	—	17/4½
13..	19/6	27/9	21/-	18/-	27/6	19/9	15/9	25/6	18/-	15/4½	—	17/9
20..	19/6	28/-	21/-	18/-	27/9	19/9	15/9	26/-	18/-	15/4½	—	17/10½
27..	19/-	29/-	21/3	17/9	28/9	20/-	15/9	27/-	18/3	15/6	—	18/-
July 4..	19/-	29/-	21/-	18/-	29/-	20/-	—	26/6	18/3	—	—	18/-
11..	19/3	28/6	21/-	18/-	28/6	20/-	—	26/6	18/6	15/6	—	18/3
18..	19/3	27/-	21/-	18/-	27/-	20/3	16/-	24/9	18/9	15/7½	—	18/3
25..	19/9	27/-	21/-	18/6	26/6	20/3	16/3	24/3	18/9	16/-	23/9	—
Aug. 1..	19/9	26/6	21/-	18/6	25/9	20/3	16/3	23/9	18/6	16/3	23/3	—
8..	20/-	26/6	21/6	18/9	25/6	20/3	17/-	23/6	18/6	—	—	—
15..	20/3	26/-	21/9	18/9	24/9	20/6	—	23/-	18/6	17/3	22/9	18/-
22..	20/-	25/-	22/3	18/6	24/-	20/6	17/-	22/6	18/9	17/-	—	18/6
29..	20/-	25/-	22/3	18/6	23/9	20/3 20/6	17/-	20/9	19/-	—	—	—
Sept. 5..	19/9	24/-	21/9	18/6	23/-	20/- 20/3	17/-	20/9	19/-	—	20/-	—
12..	19/9	23/-	21/6	18/6	22/6	20/-	17/-	20/-	19/-	16/9	—	—
19..	19/6	23/-	21/6	18/6	22/6	20/-	17/-	20/-	18/9	—	—	18/6
26..	19/-	23/-	21/6	18/3	22/-	19/9	16/9	19/9	18/6	—	—	—
Oct. 3..	19/-	22/-	21/-	18/-	21/-	19/6	—	19/-	18/3	16/6	—	18/-
10..	19/-	21/6	21/-	18/-	20/6	19/3	16/9	18/-	18/3	16/7½	16/9	17/6
17..	19/-	21/6	21/6	18/-	20/-	19/3	16/9	17/9	18/9	—	16/9	17/6
24..	19/-	21/3	21/-	18/-	19/6	19/- 19/3	16/9	17/6	18/-	16/7½	16/6	17/6
31..	19/-	20/9	21/-	18/-	19/-	19/- 19/3	16/9	17/-	18/-	16/7½	16/6	17/6
Nov. 7..	19/-	20/6	21/-	18/-	19/- 19/6	19/- 19/3	16/9	17/-	18/-	16/7½	—	17/4½
14..	19/-	20/-	21/3	18/-	19/-	19/- 19/3	16/9	17/-	18/3	16/6	—	17/7½
21..	19/-	20/-	21/3	17/9	19/-	19/3	16/9	16/6	18/6	16/6	—	17/9
28..	19/-	20/6	21/6	17/9	19/-	19/3	16/9	16/6	18/6	16/6	—	18/-
Dec. 5..	19/3	21/-	22/-	17/9	19/-	19/6	16/9	16/9	18/9	16/6	—	18/-
12..	19/3	21/-	22/-	17/9	19/-	19/6	16/9	—	18/6	16/6	—	18/-
19..	19/3	21/-	21/9	17/9	18/9	19/6	16/9	—	18/6	—	—	18/-
26..	19/3	20/6	21/9	17/9	18/6	19/6	16/9	—	18/6	—	—	18/-

H. H. HANCOCK & Co., 27, Mincing Lane, London, E.C.

IMPORTS AND EXPORTS (UNITED KINGDOM) OF RAW AND REFINED SUGARS.

January 1st to December 31st.

Board of Trade Returns.

IMPORTS.

Raw Sugars.	Quantities.		Value.	
	1889.	1890	1889.	1890.
	Cwts.	Cwts.	£	£
Germany	5,804,488	6,888,111	4,489,156	4,215,064
Holland	420,376	429,883	344,318	250,313
Belgium	1,284,397	1,301,701	826,495	777,380
France	592,390	1,393,694	402,139	887,446
British West Indies & Guiana	1,880,576	1,338,255	1,768,593	1,018,833
British East Indies	1,720,579	710,736	1,169,678	367,571
China and Hong Kong	51,334	....	38,346	....
Mauritius	307,882	249,528	294,312	157,687
Spanish West India Islands	49,735	42,130	44,370	31,597
Brazil	720,638	430,847	513,745	259,369
Java	2,327,212	1,377,241	1,989,812	979,886
Philippine Islands	1,033,649	566,187	611,929	308,688
Peru	701,853	607,120	564,473	412,246
Other Countries	648,457	382,053	568,718	269,018
Total of Raw Sugars	17,543,566	15,717,486	13,626,084	9,935,098
Molasses	396,210	563,687	146,503	184,416
Total Sugar and Molasses	....	....	22,652,684	18,260,884
Refined Sugars.				
Germany	4,140,325	5,002,856	4,107,883	4,049,367
Holland	1,355,913	1,785,365	1,352,133	1,488,106
Belgium	252,798	176,378	264,173	157,013
France	2,633,000	2,701,433	2,512,917	2,185,822
United States	10,201	292,895	9,981	245,534
Other Countries	631,702	18,648	633,010	15,528
Total of Refined	9,023,939	9,977,575	8,880,097	8,141,370

EXPORTS.—Refined Sugars.

	1889.	1890.	1889.	1890.
	Cwts.	Cwts.	£	£
Sweden and Norway	95,374	64,886	81,210	48,680
Denmark	141,348	132,308	104,302	81,946
Holland	102,289	92,818	81,773	66,196
Belgium	29,067	28,272	21,791	19,723
France	7,662	4,806	5,844	3,142
Portugal, Azores, & Madeira	96,220	82,587	74,629	55,956
Italy	107,986	72,093	88,933	49,437
Other Countries	175,069	231,771	150,633	179,534
Total of Exports	755,015	709,541	609,115	504,614

IMPORTS OF FOREIGN REFINED SUGAR.

The British Sugar Refiners' Committee furnish us with the following figures, giving the imports of foreign refined sugar for the month of December, 1890, compared with the corresponding month of the two preceding years, and the average monthly imports for the year compared with those of 1887, 1888, and 1889, distinguishing the quantities of "Lumps and Loaves" from "other sorts," and giving the separate imports from each country:—

Countries from which Sugar has been imported.	"LUMPS AND LOAVES."							"OTHER SORTS." Including Crushed Loaf, Granulated, Crystallized, &c.							TOTAL.						
	Monthly Average.				Dec.	Dec.	Dec.	*Monthly Average.*				Dec.	Dec.	Dec.	*Monthly Average.*				Dec.	Dec.	Dec.
	1887	1888	1889	1890	1888	1889	1890	1887	1888	1889	1890	1888	1889	1890	1887	1888	1889	1890	1888	1889	1890
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France	1363	1686	2373	2707	1792	4141	1819	5099	4855	8596	8547	16853	17662	12868	6462	6541	10969	11254	18645	21803	14687
Holland	3780	3267	2294	2858	3943	2168	1972	2483	2675	3354	4580	3122	4189	3762	6263	5942	5648	7438	7065	6357	5731
Germany & Austria	1347	1510	2573	2512	3277	3232	3158	10463	11729	13844	18333	25803	19582	28087	11810	13239	16417	20845	29080	22814	31245
Belgium	592	622	827	390	1012	1597	343	308	227	225	344	368	307	261	900	849	1052	734	1380	1904	604
United States	454	8	..	96	..	..	30	2804	157	42	1123	56	8	1624	3258	165	42	1219	56	8	1654
Russia	3	..	23	25	..	..	300	452	1959	2015	29	3663	10	346	455	1959	2038	54	3663	10	646
Other Countries	..	1	239	..	..	..	..	15	2	355	..	..	..	..	15	3	594	..	..	..	..
Total	7539	7094	8329	8588	10024	11138	7622	21624	21604	28431	32956	49865	41758	46948	29163	28698	36760	41544	59889	52896	54570

SUGAR STATISTICS—GREAT BRITAIN.

FOR THE FOUR PRINCIPAL PORTS.

For Three Weeks, ending January 17th, 1891 and 1890.
In Thousands of Tons, to the nearest Thousand.

	STOCKS.		DELIVERIES.		IMPORTS.	
	1891.	1890.	1891.	1890.	1891.	1890.
London	27	46	7	11	8	8½
Liverpool ..	48	82	16½	15	13½	11½
Clyde......	37	41	4½	10	5	10½
Bristol	3	4	3	4½	2½	6
Total ..	115	173	31	40½	29	36½

The above figures do not represent accurately, or to the full extent, the position and movements of sugar in the United Kingdom, as Hull, Leith, &c., are not included, there being no published returns for these ports.

SUGAR STATISTICS—UNITED STATES.

(From Willett & Gray's Report.)

For the four principal Ports. In Thousands of Tons, to the nearest Thousand. For December, 1890 and 1889.

	STOCKS. January 1st.		DELIVERIES. In Dec.		IMPORTS. In Dec.	
	1891.	1890.	1890.	1889.	1890.	1889.
New York	22	10	45	37	50	36
Boston	5	1	5	6	7	6
Philadelphia....	1	..	44	16	44	16
Baltimore	..	..	..	..	..	..
Total......	28	11	94	59	101	58
Total for the year..........			1196	..	1213	1009

NEW YORK PRICES FOR SUGAR.

From Willett & Gray's Report, January 15th, 1891.

Fair Refining.	96o/o Centfs.	Granu-lated.	Stand. A.	Stock in Four Ports.
Jan. 15, 1891.—4⅝-¾c.	5⅜-½c.	5 15-16c.	5 11-16c.	Jan. 1, 1891— 27,756 tons.
Jan. 16, 1890.—5¼c.	5⅞c.	6½c.	6¼c.	Jan. 1, 1890— 11,169 tons.
Jan. 17, 1889.—4⅞c.	5⅝c.	7c.	6 11-16-¾c.	Jan. 1, 1889— 32,254 tons.
Jan. 19, 1888.—5 5-16c.	6c.	7⅛c.	6⅝c.	Jan. 1, 1888— 47,798 tons.
Jan. 20, 1887.—4⅝c.	5 3-16c.	5⅞c.	5 7-16c.	Jan. 1, 1887—102,279 tons.
Jan. 21, 1886.—5½c.	6⅛c.	6⅝c.	6¼c.	Jan. 1, 1886— 57,328 tons.
Jan. 22, 1885.—4 15-16c.	5½c.	6⅜c.	6c.	Jan. 1, 1885— 89,186 tons.
Jan. 17, 1884.—5 13-16c.	6 11-16c.	7 13-16c.	7 7-16c.	Jan. 1, 1884— 60,900 tons.
Jan. 18, 1883.—6⅞c.	7 11-16c.	8 9-16-⅝c.	8½c.	Jan. 1, 1883— 50,297 tons.
Jan. 19, 1882.—7¼c.	8c.	9⅜c.	8⅞c.	Jan. 1, 1882— 43,927 tons.

STOCKS OF SUGAR IN THE CHIEF MARKETS OF EUROPE ON THE 31ST DECEMBER, 1890, FOR THREE YEARS, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal *entrepôts.*	TOTAL 1890.	TOTAL 1889.	TOTAL 1888.
119	455	240	324	40	21	1199	1301	898

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING 31ST DECEMBER, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal *entrepôts.*	TOTAL 1890.	TOTAL 1889.	TOTAL 1888.
1330	509	538	306	52	383	3118	2845	2738

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE PRESENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1890-91. Tons.	1889-90. Tons.	1888-89. Tons.	1887-88. Tons.
German Empire ..	1,325,000 ..	1,264,607 ..	990,604 ..	959,166
France..........	760,000 ..	753,078 ..	466,767 ..	392,824
Austria-Hungary..	750,000 ..	787,989 ..	523,242 ..	428,616
Russia..........	530,000 ..	456,711 ..	526,387 ..	441,342
Belgium	200,000 ..	221,480 ..	145,804 ..	140,742
Holland	50,000 ..	55,813 ..	46,040 ..	39,280
Other Countries..	75,000 ..	80,000 ..	87,000 ..	79,980
Total....	3,690,000	3,619,678	2,785,844	2,481,950

It will be seen that the following changes in the estimates have been made since last month, viz.: Germany, 15,000 tons more, and France and Austria each 10,000 tons less, the net result being only a reduction of 5,000 tons.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

The business in cane sugar has fluctuated considerably during the past month, the greatest activity having been in grocery kinds, which in the middle of the month found steady sale at slightly advanced prices; and in crystallised sorts, which were in fair demand. Owing to the frost on the Continent, and the consequent difficulty in getting forward any quantity of beet, refining sorts were for a time in request, but the milder weather put an end to this, and prices close on the whole about the same as, or slightly lower than last month.

The refined market was also affected by the difficulty of obtaining beet for refining purposes, and cubes and titlers are dearer than at the end of 1890; foreign sorts closing at about the same or slightly higher prices.

Under the influence of the interrupted navigation on the Continent, quotations for beet advanced, but the speculative market was rather dull, and the advance established has been only insignificant, the closing tendency being weak. This is not to be wondered at, considering that the continental statisticians adhere very firmly to their estimate of a crop rather in excess of last season.

As compared with last year, stocks on the 31st December, in Europe and North America were some 70,000 tons smaller, while the increase in consumption is estimated by Mr. Licht at 371,000 tons for the last year in the two countries. In view of the lower prices in the States, under the new tariff, a still higher rate of increase in the consumption may be looked for, and the position may be considered a strong one.

Present quotations for the standard qualities, as under, are:—

FLOATING.			Last Month.
Porto Rico, fair to good Refining	12/9 to 13/9	against	12/9 to 13/9.
Cuba Centrifugals, 97°/° polarization	14/3	,,	14/3
Cuba, fair to good Refining	12/9 to 13/3	,,	12/9 to 13/3.
Java, No. 14 to 15 D.S...	15/- to 15/3	,,	14/6 to 15/-.
British West India, fair brown..	12/-	,,	12/-
Bahia, low to middling brown	11/- to 11/6	,,	11/3 to 11/9.
,, Nos. 8 to 9	12/- to 12/6	,,	12/- to 12/3.
Pernams, regular to superior Americanos.	11/3 to 12/9	,,	11/6 to 12/9.

LANDED.			Last Month.
Madras Cane Jaggery..	10/- to 10/3	against	10/3
Manila Cebu and Ilo Ilo	9/9 to 10/-	,,	10/-

Paris Loaves, f.o.b...	16/9	against	16/9
Russian Crystals, No. 3, c.i.f.	15/-	,,	14/10½
Titlers	18/3	,,	18/-
Tate's Cubes..	20/-	,,	19/3
Beet, German and Austrian, 88%, f.o.b. ..	12/8	,,	12/4½

THE
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☞ The writers alone are responsible for their statements.

All communications to be addressed and all cheques, &c., made payable to "Edward Sutton, Editor of The Sugar Cane, Manchester," which address is sufficient.

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The Jamaica Exhibition was opened on the 28th January by Prince George of Wales with great éclat, and bids fair to prove as great a success as the most sanguine of its promoters could have anticipated. What a wonderful prospect of advancement is opened up may be judged of from the following statements:—"In manufactures and even handicrafts our people are very children. In agriculture we are little further advanced than we were two hundred years ago. Literature, science, and art are unmeaning words to all but a very few amongst us."

Apropos of bounties on home-produced beet sugar in America, we would call special attention to an extract on page 155 from the New York *Merchants' Review*, in which a note of warning is sounded to investors, pointing out the insecurity of the foundation on which the present success of that industry is based. We may add that the Grand Island factory received a building subsidy of $150,000.

The question whether it might not pay to import Cuban molasses into this country for refining, the sugar being marked and warranted "Genuine Cane" production, has of late frequently occurred to us, and acquires some added interest from a communication on the subject to the *Havana Weekly Report* which we reproduce this month. The continuation of the import of molasses to the United States is more than doubtful, as we learn from good authority that the price in the States has now fallen so low that they have become practically valueless, and the medium and lower sorts may have to be thrown away unless

some new means can be devised for their disposal. See also the remarks of the Havana *Revista de Agricultura* on the probable effect in this direction of the McKinley Tariff, on page 625 of our December issue.

Considerable interest is now concentrated on Brazil, as the first country with which a Reciprocity Treaty has been concluded by the United States.

The Constitution has been proclaimed and the President (Marquis de Fonseca) elected. An English journal, usually well posted up, has some pertinent observations on the question, and we have reproduced them on page 124. The following are the remarks of the ultra-Protectionist *American Economist*, betraying apparently a feeling that the matter is not quite so clear as they would wish :—

"The advantages of this or any other similar treaty depend upon the special terms accorded to this country as to the rates of duty imposed on its productions. Whenever these or similar terms are accorded to other nations our advantages cease. The question now suggests itself, How long will the great trading and manufacturing nations of Europe quietly submit to the diversion of their Brazilian trade to the United States? We do not attach special importance to the favoured nation clause. But it is clear that the Brazilian Government must, under all rules of international comity, show valid reasons for the preference given by this treaty to exports from the United States or grant the same privileges to all others. Here, then, is a puzzle for time to solve. We shall follow the developments under the new treaty with great interest. The subject is worthy the brilliant statesman from whose fertile brain the scheme of reciprocity proceded, and who, we are confident, will find the way to remove every obstacle to its success."

On the other hand, another New York paper of opposite views expresses itself as follows :—

"Mr. Blaine's reciprocity treaty with Brazil may or may not cause a material increase of our commerce with that country; it is at any rate a step in the right direction, and probably will be favourably received by the mass of the American people, which last November recorded a verdict of disapproval of the Mc.Kinley tariff. Whether the treaty will be an advantage to this country will depend upon the action of Brazil towards our European rivals. If she refuses to discriminate between them and our own exporters, the latter cannot

compete with their foreign rivals in Brazilian markets any more than they can do so here, owing to the duties on their raw materials. If they can compete with foreigners in Brazil, they can hold their own here without any duties on manufactured goods. This has been pointed out in the *Merchants' Review* in earlier issues when the subsidy schemes were being considered. Much as we approve of Mr. Blaine's desire to expand our commerce with South America, we are afraid that the reciprocity treaty will prove a delusion."

Messrs. Willett and Gray write:—As anticipated by us, the Hon. James G. Blaine, Secretary of State, has shown no delay in putting into operation the Reciprocity programme marked out by the McKinley Bill. A treaty is already completed with Brazil, and proclamation issued. A treaty is in progress with Spain, covering reciprocity with Cuba, which is sure to be completed soon. As the Honourable Secretary has a lively interest in having the business brought about by reciprocity done by American shipping, a subsidy bill is very sure to accompany reciprocity. The two conditions—reciprocity and subsidy—will go hand in hand, and immense benefits result to the United States.

We learn from Cuba, that holders are not disposed to part with sugar at the prices obtainable, and it is probable this will have a considerable effect on the turn prices may take here.

Crop Reports and Plantation News.

(From the *Havana Weekly Report.*)

After the showers fallen towards the middle of the past month, the drought has set in again, and several new cane field fires have been reported, the most important one having taken place at St. Nicholas, on estate "Guadalupe," which lost a quantity of cane estimated at 150,000 arrobes.

Owing to this circumstance, planters generally complain about the scantiness of the cane yield in juice; still, the crop is favourably going on, and nothing has as yet happened to mar the brilliant expectations entertained from the beginning.

The difficulties that Central "Parque Alto" experienced in the working of its machinery at the commencement of the campaign now under the way, having been successfully overcome, said plantation is now turning out from six to seven hundred bags of sugar, equivalent to an average daily production of 130 hhds.

The scarcity of able field labourers continues to be severely felt, and planters will not be able to obtain the number they need until the totality of the tobacco crop is harvested at Pinar del Rio, Remedios, Sagua and Manzanilla.

An item worthy of special mention, is that on account of high rates charged by the railroads for freight to Caibarien, two estates in that locality will haul their sugars and molasses this year to the sea port, on carts.

The manager of the sugar central factories, which a French Syndicate are establishing around the Bay of Nipe, on the N.E. side of this Island, has just entered with the tenants of the company into a new contract, according to which all those previously made are annulled, and the price of the cane delivered by them in 1892, in which year the first of said factories will be ready to commence to grind, has been agreed upon.

As the concession of the Nipe Company comprises over 5,000 hectares of land, only a part of it will be sown with cane and the balance devoted to the culture of coffee, cocoa, and other tropical plants, for which all the necessary arrangements are being conducted with great activity.

Barbados reports are somewhat more favourable, and planters' hopes of a tolerable crop are rising.

There appears to be little doubt that the *sereh* disease, which has made such havoc in Java, has made its appearance in Queensland. A letter to the Brisbane *Queenslander* of January 17th will be found on page 143. Unless the experienced cultivators and able chemists of Java have much overstated matters, the writer of the letter must be seriously under-estimating the importance of this appearance of the disease.

According to *Revue Agricole de Maurice*, the results obtained by diffusion on the Britannia are: sugar, 10·95 per cent. on the weight of cane; quantity of coal burned, about 2·85lbs. per ton of sugar made; average sugar turned out per day, 87½ cwt. The sugar content of the canes averaged 13·45 per cent. of the weight.

GERMAN AND FRENCH SUGAR LEGISLATION.

As stated in our last, the Commission of the Reichstag disagreed with the whole of the proposals of the Government scheme, and nothing has as yet been settled. It appears unlikely that anything will be done this side of Easter, and the opinion seems (with great reasonableness) to be gaining ground, that the Government will wait the result of pourparlers respecting the commercial treaties with Austria-Hungary before taking any definite step. The want of unanimity among those most interested has led, both in this case and that of France, to the respective Governments apparently deciding to follow their own course. In France, the proposal to put the discussion of the new proposal on the order of the day, was rejected on the 21st February, by a considerable majority; the question will, therefore, be again delayed, as the Chamber seems to have had enough of it for the present.

Messrs. Geo. Stade & Co., of Berlin, (whose advertisement appears in our columns) have struck out a new idea in making arrangements for the despatch (quarterly at first, eventually monthly) of batches of circulars, catalogues, price-lists, &c., to all the civilised countries of Asia, Africa, North and South America, and Australia, at a fixed charge for every 2,000 copies, securing their delivery direct to those most interested. The idea seems feasible and well worth the trial. Size and weight of circulars can be known on application.

A PERUVIAN SUGAR PLANTATION.

The hacienda of Caudivilla is a very extensive sugar plantation and refinery in the valley of the Chillon, situated not far from Ancon. The estate occupies four square leagues of ground on both banks of the river, about three-fifths of which consist of cane plantations, and the rest of alfalfa, corn, and pasture. The mill, built in 1866, is provided with machinery from Philadelphia; it has a productive capacity of 3,000 Spanish quintals a month, and appears to be a model establishment of the kind. A North American engineer is in charge of the machinery. The buildings are very commodiously arranged around a square, enclosed with high walls and monumental gates. On one side of the square is the mill; on another the offices and a

dwelling-house, with comfortable accommodation for visitors, and all facilities for exercising liberal hospitality; on the third side are stables, a hotel and restaurant for employés, and a *tambo*, or store; and on the fourth side *bodegas*, or warehouses for bagging and stocking the manufactured sugar. The square is traversed by a broad gauge railway and by movable Decauville tracks, along which the cane is brought in from the plantations on trucks, and unloaded directly into the conductor, or piled in a heap when the trains come in too rapidly. This corner of the yard always presents a busy scene when the mill is at work. Men and boys, negroes, Chinese, and Peruvians are seen hurrying to and fro carrying bundles of canes in their arms and depositing them in the conductor, which creeps along with its endless load like a monstrous serpent, and disappears through a hole in the wall into the hopper of the crushers. The *tambo* is an interesting and exceedingly profitable element of the estate. The *tambo* is simply a store like any other, only it is better provided with merchandise, and it is the only establishment of the kind for many miles around. The Indians come down from the Sierra to buy things at the Caudivilla *tambo*, and the article which they chiefly consume is rum of 30° proof, distilled in the sugar refinery to the amount of between 8,000 and 10,000 gallons a month, all of which is sold in the *tambo* or in Lima, chiefly to Indians and natives of mixed race, who call this spirit "chacta."

An establishment of this kind, employing in all about 800 men, has to be self-sufficing; and so, besides the mill proper and its appurtenances, there is a fitting shop, a wheelwright's shop, and a saddlery, where harness is made and repaired for the teams of mules and oxen. On the estate are several villages, where the men live with their wives or concubines in singularly primitive conditions, and form a strangely mixed community of Chinese, negroes, and mixed breeds. Not many years ago this *hacienda* was cultivated by gangs of coolies and African slaves, who were locked up at night in large yards, like stables, which now remain useless. The modern villages are composed of blocks of bamboo cane huts, plastered over with mud and roofed with cane, also plastered. Many of the Chinamen are traders, and sell drinks and various articles to the negroes and Peruvians. The explanation of this competition with the retail store of the estate is that the *tambo* does not give credit and John Chinaman does. The Chinese from the other estates in the Chillon Valley go to

the Caudivilla pagodas on grand days, and celebrate with gongs and cries the feasts of their creed. All this seems strange and amusing, and looks well enough in a picture; but in reality it is a scene of squalor, in the midst of which are human beings living in conditions scarcely worthy of brute beasts. In Peru the conflict of labour and capital has not yet been even dreamed of. The wages paid on this estate may be taken as indicating the high average in agricultural Peru. The mill hands earn from 50 to 70 cents Peruvian currency a day, and receive gratis a ration of rice. The firemen who feed the furnaces with *bagazo*, or refuse cane after it has been crushed, receive 60 to 90 cents, with a ration of beans and rice, and once a week meat. The field hands, who work in the pampa cultivating or cutting the cane—men and women alike—receive a ration of 1½lbs. of rice a day and wages of from 50 cents upward. The cane cutters work by the piece, and can gain a maximum of $1·20 Peruvian currency a day; but their weekly maximum never exceeds $7. All the workmen are lodged gratis.

The sugar plantations are distributed along both sides of a private railway, about five miles long, which connects the mill with the main line to Lima.

In this rainless valley everything depends upon irrigation; where there is no water there is no vegetation; and so, at the edge of the plain, the moment the land begins to rise, there is not a speck of green to be seen. Nevertheless, in the days of the Incas, whose ruined towns abound on the lower slopes of the hills all along these coast valleys, the higher ground was cultivated by means of terraces and irrigation, the water being probably brought from reservoirs of rain water higher up. This problem, however, has not yet been satisfactorily solved, and on some of the hill sides where the Inca terraces remain, it seems impossible to have conveyed water by means of canals and *acequias*. On the Caudivilla estate there are the ruins of a considerable Inca town, which appears to have been strongly fortified. Huge masses of adobe walls are still standing, and anyone who takes the trouble to violate the graves may dig up mummies, pottery, slings, and domestic implements and ornaments to his heart's content.—*Harper's Magazine.*

PRODUCTION OF SUGAR IN JAVA.—CROP 1889.

BY SIR N. P. VAN DEN BERG.

(From *De Indische Mercuur.*)

Though the majority of the interested parties whom I addressed by letter of 31st December, 1889, begging them to supply me, as soon as possible, with the facts and dates necessary for continuing, for the crop-year 1889, the calculations of the cost price of the sugar produced in Java (begun with the crop-year 1885), promptly granted this request, so that about the middle of the past year I was already in possession of data from some 60 manufacturers; still some data were withheld longer than I had wished, and this is the reason that my comparative review only appears now, when it has already lost a good deal of its immediate interest. Moreover, it is less complete than before, for, in the entire absence of one communication which was formerly regularly supplied, my calculations include this time only 93 manufactories, against 104 in 1888, and as many as 115 in 1885. This would not justify me in leaving unused the material so kindly supplied to me by others*; all the less so as the missing communication only concerns one province, viz., the Vorstenlanden, and the average figure of the rest of the residencies is in no way affected by it.

As regards the production, the sugar crop of 1889 shows unfavourably against those of the last preceding years, for, according to the "*Indication of the quantities of produce, prepared by owners of agricultural estates in Java and Madoera,*" published by Government as a supplement to the *Javasche Courant*, it amounted to—

	Crop 1888. Pic.	Crop 1889. Pic.
A. Government Contracts	3,754,643 ..	3,649,989
B. Free agreements with the population ..	1,367,814 .	1,332,782
C. Rented—or leased on grands estates	150,845 ..	170,058
D. Private estates	98,088 ..	102,280
E. Estates in the Vorstenlanden..	886,747 ..	661,033
	6,258,137	5,916,142

* Data were supplied to me by the Factory of the Netherlands Trading Company; Netherlands-India Agricultural Company; International Credit and Trading Association, Rotterdam; Colonial Bank; Trading Association, Amsterdam; Company for Working the Sugar Estates of Sentanen-lor, Brangkal, and Dinoys, and Messrs. Maclaine, Watson & Co.; Reynst & Vinju; Tiddeman & Van Kerchem; Mirandolle, Voute & Co.; and H. M Ament.

Whilst the same "*Indications*" show that the production attained:—

	Pic.
In 1887..	6,568,856
,, 1886	6,338,610
,, 1885..	6,260,215
,, 1884	6,493,248
,, 1883..	5,348,867
,, 1882	4,809,322
,, 1881..	4,606,780

The production of 1889 was thus about 460,000 pic. under the average figure of the five preceeding years, a difference which is almost wholly explained by the greatly diminished yields of the sugar estates in the Vorstenlanden, which decreased from 1,063,000 pic. per year in the quinquennial period of 1884-1888 to the above-mentioned quantum of 661,033 pic. in 1889. Excluding the insignificant sugar manufacturies on the private estates to the west of the Tjimanoek, the number of the sugar concerns in Java, as shown in the Colonial reports, amounts to:—

A. Government contracts	89
B. Free manufactures	56
C. Rented, or leased on grand, estates	11
D. Estates in the Vorstenlanden	32
Total	188

the aggregate produce of which amounted in 1889 to 5,813,862 pic., whereas figures were supplied to me for a quantity of 3,472,026 pic. (from 93 estates), relating therefore to about 60 per cent. of the total crop. For an exact knowledge of the state of affairs, it would undoubtedly have been desirable for a larger percentage of the crop to be considered in the calculation; but, nevertheless, what I have been able to collect is, speaking comparatively, of value, though I could have wished to give more complete details.

Repeating my observation, that the figures supplied to me are used in the same manner as before, I now proceed to the comparative review of the crop, years 1885 to 1889 included.

Leaving out of the calculation, as hitherto done, the highest and lowest member of the series, the average figure of which we are seeking, viz., Semárang, with an average price of f. 9·59; and Banjoemaas, with an average price of f. 5·40, we find:—

In the crop year.	For the remaining quantity of pic.	An average price of f.
1885	4,026,821	8·06
1886	3,989,430	7·78
1887	3,953,179	6·63
1888	3,598,675	6·60
1889	3,303,467	7·19

and we may assume as tolerably certain that the cost of production of Java sugar, in 1889, has been on an average about 60 cents per picol higher than in the two preceding years, 1887 and 1888.

This result agrees perfectly with what might *a priori* be expected. The struggle with the *sereh* disease, to the fatal effect of which the decreased production in the Vorstenlanden may be ascribed, and which elsewhere also caused so many disappointments, rendered expenses unavoidable, which in most cases increased the cost price of the sugar to a completely abnormal rate, let alone the fact that the small production must in itself have a prejudicial effect on the cost price; but even in those provinces of Java, where the pest was still unknown, as was the case in the eastern part of the island generally, the cost was greater because of the rainy state of the weather, at any rate, at the beginning of the campaign of 1889, a circumstance, the great influence of which was shown very clearly in "*Notes on the Sugar Industry in Java, and the measures required for its maintenance*, by *Mr. W. Suermondt Wz.*, which the present writer presented, by request, on the 30th Nov., 1886, to the Second Chamber of the States General.

Meanwhile, the financial result of the crop 1889 was not unfavourable for the greater number of the sugar estates, because, as I have already remarked in "*De Indische Mercuur*" of 4th January, 1890, No. 1, it was generally possible to bargain for a price of *f.* 9 to *f.* 10 per picol, for the produce of that year. But for the produce of the crop of the past year (1890), sellers have had to be contented with an average of *f.* 1 per pic. less, and though this in itself may not be a reason for in the least doubting the possibility of carrying on the sugar industry in Java, yet on the other side the experience of 1889 teaches us with how many adverse circumstances this industry still has to struggle, and how unreasonable is the attempt to impose upon it new burdens at the present time, merely because under existing circumstances some privileged estates may have been able to show favourable results. What I said with regard to this attempt in the above-mentioned number of your paper, still remains fully applicable, and will do so as long as the pressure of interested parties in Europe, desirous of favouring the beet-sugar industry at the expense of that of the cane, is not put a stop to.

COMPARATIVE REVIEW OF THE CROP, YEARS 1885 TILL 1889 INCLUDED.

RESIDENCES.	Number of Manufactures.					Total Quantity in Picols.					Cost Price without interest on Capital or Debts.				
	1885.	1886.	1887.	1888.	1889.	1885.	1886.	1887.	1888.	1889.	1885.	1686.	1887.	1888.	1889.
											f.	f.	f.	f.	f.
Cheribon	9	9	9	9	8	174,993	223,778	240,069	225,983	209,227	11·49	8·10	7·29	6·95	7·26
Tagal	7	8	9	9	9	254,143	250,249	251,014	261,425	318,100	8·37	9·32	8·02	8·15	7·79
Pekalongan	5	5	5	5	5	175,007	198,921	198,600	148,541	200,535	9·82	8·46	7·44	7·88	7·28
Samarang	4	4	4	4	3	184,639	178,838	217,450	222,786	106,059	7·76	7·53	6·08	6·23	9·59
Japara	10	9	8	6	7	417,998	415,879	384,331	285,344	291,178	8·61	7·67	6·52	6·74	7·55
Soerabaja	18	17	21	22	22	677,138	614,506	902,653	957,094	926,294	8·19	8·03	6·52	6·16	6·86
Pasoeroean	6	6	5	5	5	198,179	181,131	194,358	211,228	198,863	9·74	8·79	6·72	6·47	7·06
Probolingo	14	13	9	8	6	515,500	441,747	358,506	285,640	206,866	8·28	8·16	6·60	6·49	7·20
Besoeki	7	7	5	4	4	330,528	319,538	248,405	212,345	202,787	6·95	6·82	5·68	5·56	6·05
Banjoemas	1	1	1	1	1	59,250	57,569	60,000	62,530	62,500	5·50	5·51	4·93	5·02	5·40
Vorstenlanden	27	26	24	23	15	1,003,000	955,634	915,395	665,954	356,243	7·12	6·99	6·66	7·21	8·17
Madioen	2	2	2	3	3	59,175	66,644	76,864	157,169	166,249	9·70	9·36	7·87	6·85	6·59
Kediri	5	5	5	5	5	190,950	209,209	216,548	226,591	226,925	8·48	8·15	6·75	6·69	7·19
	115	112	107	104	93	4,240,520	4,113,643	4,264,193	3,922,630	3,471,826	8·16	7·77	6·68	6·67	7·24

BRAZIL.

We have from time to time referred (see *Sugar Cane* for December, 1889, and February, 1890,) to the course of affairs in this great and comparatively undeveloped country, which must have been followed with interest by many not connected with it by business ties. News just received from Lisbon seems to confirm the grave statements which were current a short time ago, accusing the Republican Government of wholesale jobbery and corruption, and which at the time were contradicted by the Brazilian Ambassador. It must be admitted that if the statements respecting the course taken by President Fonseca are correct, and they seem undeniable,—to the effect that regarding "gold as useless money", he deprived the banks of it to redeem certain internal loans, in consequence of which £60,000,000 of notes and £17,000,000 of Government paper have absolutely no gold to support them,—then the occurrence of a monetary crisis at Rio can scarcely be staved off, especially considering that new companies were last year formed with a nominal capital of £133,000,000.

The *Diario de Pernambuco*, commenting on the course of trade in that State during 1890, considers that the year has been a prosperous one regarded from an economical and commercial point of view, the production of cotton having been but little inferior to the average of the five preceding years, and although that of sugar, as such, had diminished, the quantity of brandy and alcohol, which after all are only sugar in a state of transformation, had increased considerably.

As regards the machinery and apparatus connected with the sugar industry, further progress had been made in that State in transforming the old processes, inasmuch as besides the factories subsidised by the Central and State Governments, many of the estate owners had been induced to abandon their old routine, and replace their old machinery by new and more perfect appliances, which extract a larger proportion of sugar from the cane.

The *Diario* remarks:—"It is evident that by its own initiative, favoured by the governing authority, and sustained by the commercial houses, this industry is succeeding in raising itself to a position in which it is able to sustain a severe competition such as that of the beet; and the man must be blind who cannot see that, favoured by the virgin soil and continued progress, the cane will finally come out the victor.

It is a scientifically established fact, that for an equal weight and volume, the cane contains a much greater proportion of sugar than the beetroot. The question and struggle between them is therefore summed up in the extractive processes, and the appliances for those processes. And it is evident that with equal mechanical conditions, and reduced rates of transport, and having monetary facilities for its promotion, the cane industry will conquer that of the beetroot, and regain its ancient position in the commercial world.

To sum up, we think that happy days, perhaps at no very distant date, are still in reserve for our industry, and therefore for the commerce which subsists on, and is so closely allied to it; and the year which has just closed furnishes more than one ground for this opinion, seeing that, notwithstanding the relative fall in the prices of sugar and other products derived from the cane, these products are indicating an advance in the local industry, having exceeded in 1890 the average value of the preceeding five years.

Pernambuco possesses in itself the elements necessary for its evolution. The total withdrawal of its vital sap by the central authority, was the primary cause of the extinction of its vitality. Let the Republic restore to it that which the Monarchy had withdrawn, and it will march boldly on in the path which leads to prosperity."

By an official degree, dated the 4th October, 1890, the Brazilian Government amplified the original concessions, details of which will be found in the *Sugar Cane* for February, 1890. The following is the text of the decree:—

Factories which are in the receipt of the guarantee on their invested capital, will continue, in principal, to enjoy the liberty of using those manufacturing processes which they may prefer; but the State reserves to itself the right eventually to require the adoption of the diffusion process, and, in this case, the guarantee of interest will be extended also to the capital invested in the new process.

A Commission of three members is appointed for the purpose of studying, in Brazil and other countries, all the facts relating to diffusion; they will present a report every three months of the results of their investigations.

To form a stimulus towards making trials of diffusion, the following premiums are offered:—

1. One of 100,000 milreis for the factory which, with the lowest cost of production, shall obtain a yield of at least 12 per cent. of sugar.

2. One of 60,000 milreis for the factory which, with the lowest cost of production, shall obtain a yield of 11 per cent. of sugar.

3. One of 30,000 milreis for that which, under the same conditions, shall obtain a yield of 10 per cent.

These premiums will be granted once in each year up to 1899, and will be conferred in accordance with the report of the Commission already mentioned.

BRAZIL AND RECIPROCITY UNDER THE MCKINLEY TARIFF.

The following, taken from the *Manchester Guardian* of February 18th, is not without interest, though everything connected with the McKinley Bill must be considered, as we have been warned by Messrs. Willett and Gray, of New York, as open to the utmost uncertainty as regards its eventual developments :—

If we may rely upon the accuracy of a telegraphic despatch from Bahia published by the *New York World* on Tuesday, it appears to be pretty certain that the treaty of commerce recently arranged between the Governments of the United States and Brazil will come to nothing. The treaty is, of course, inoperative until it has been ratified, and this conclusive act cannot be accomplished until the new Republican Constitution has been confirmed. The ratification depends, therefore, upon the terms of the Constitution, which are not yet finally settled; and it is quite possible that Mr. Blaine's energetic efforts to establish a reciprocity treaty with Brazil may raise a serious question in that country as to the possession of the treaty-making power. Apart from this consideration, however, other obstacles have appeared. The mercantile community of Brazil do not like the treaty. Exporters of Brazilian produce, it is said, will not find their business improved by it, because the English markets and their established connections here will still offer to them the best channels for their trade. Brazilian importers of goods from Europe can hardly hope for any substantial advantage from the treaty, since there are not many articles which they can obtain on better terms from the United States, even allowing for the differential duties, than those upon which they now receive them from this side of the Atlantic. It must not be assumed, however, as certain that Mr. Blaine will abandon or will finally fail in effecting his purpose. The

political influence of the mercantile community in Brazil is undoubtedly great, but the United States Secretary of State has set his heart upon carrying out his design of creating an American Zollverein, and he will use his power to the utmost in order to accomplish it. Even if he should succeed, however, it may still be possible, and it certainly ought to be possible, for us to secure for English goods "most favoured nation" treatment in Brazil. It would be strange indeed, if a nation which for nearly half a century has consistently pursued a Free Trade policy were to find itself for the first time denied the most advantageous conditions of trade with a foreign country.

SACCHARINE.

It would appear that we have not by any means heard the last of this substance, and presumably those similar compounds of excessive sweetening power which have since been obtained like saccharine from coal-tar residues. We alluded, in last month's editorial remarks, to the new Customs regulation adopted in Belgium, by which certain products, which are susceptible of being converted into saccharine, are subjected to the same duty as that substance. The Belgian sugar manufacturers and merchants appear to be thoroughly convinced that large quantities of saccharine are still being introduced surreptitiously into that country, to such an extent as to take the place of an amount of sugar that is sensibly evident in the returns of the consumption of that article.

On the other hand, we learn from an article communicated to the *Revue Internationale des Falsifications* of Amsterdam, by Dr. K. Kornauth, of Vienna, that a series of experiments conducted by him have led him to the following conclusions:—

1. That pure Fahlberg's saccharine possesses only slight antiseptic properties.

2. That the administration of saccharine, even in doses impossible in medical practice—to dogs, ducks, and pigs, for a lengthened period, does not produce any hurtful effect on the bodily organism.

3. The nutritive co-efficient of food is diminished by its administration.

4. The aversion which animals have been stated to show for saccharine is only individual.

Dr. Kornauth says, that the assertion of Bruylants, that a large portion of she saccharine is assimilated is not correct. Out of 1 gr. 250 of saccharine consumed, he found 1 gr. 228 in the urine. Careful experiments made on ducks and pigs indicated no diminution of digestive power in consequence of the addition of saccharine to the food.

Hager, Fischer, Rabow, Liebreich, and Stift state that animals refuse absolutely to touch saccharine, or food to which saccharine has been added, and hence they were led to suspect that saccharine was injurious. Dr. Kornauth writes: "The dogs on which I experimented at first refused food containing either saccharine or sugar. Later on they got used to sweetened food, and refused neither saccharine nor sugar. We must remember that we are absolutely ignorant of the range of sense possessed by these animals. Is it not possible that saccharine is repugnant to them because they know it to be a useless substance?"

These results seem to conflict with those obtained by severa continental chemists of eminence. Who is to decide where the doctors disagree?

BARDADOES.

RESULTS OBTAINED DURING 1890 AT DODDS EXPERIMENTAL STATION.

Want of space has compelled us to delay for a month the notice of this always interesting report, which we received in January. The subjects dealt with by Mr. Bovell are:—1. The amount and composition of the rainfall. 2. Experiments with manures. 3. Various incidental experiments. 4. Experiments with varieties of cane. 5. Experiments with cane seed, and the seedlings raised from it. 6. Investigations into the habits of some of the insect-pests of the sugar cane. We shall confine our extracts to the second and fifth of these. After detailing the location of the manure experiments, the composition of the soil, and the manner of arriving at the results, so as to make the two sets of experiments conducted, one in January and the other in June, susceptible of proper comparison, Mr. Bovell says:—

The experiments were arranged in three groups: in the first, to examine into the effects of the addition of nitrogen in different forms, in different proportions, and at different times; in the second, to examine into the effects of the addition of phosphates in different forms and proportions and at different times; and in the third, to examine into the effects of potash applied in different proportions at the same time. This year the system of manuring was the same adopted previous to the statements made by Dr. Wagner, which led to excessive quantities of plant food being applied in 1888, viz.: "that our failure to obtain constant increases in the yield of canes by the addition of increased amounts of nitrogen, was due to our not having used sufficient phosphates to allow the nitrogen to exert its full effects; and that the failure to obtain increased yields by excessive manurings with superphosphates of lime was due to our having neglected to apply sufficient nitrogen." As the results last year showed the fallacy of Dr. Wagner's contention, the quantities of nitrogen, phosphates, and potash applied for this year's experiments were in such proportions as our previous experience had led us to believe was sufficient to allow of the full development of the effects of the manurial constituent experimented with.

The constituents of the manures used for the January application were supplied by Mr. H. E. Thorne of the "Antilies" manure works; those used for the June application were very kindly presented to the Station by the managers of the London Agency of the Anglo-Continental (late Ohlendorffs) Guano Works: and I here beg to tender them the thanks of Professor Harrison and myself for their gift.

The manures were mixed and applied under the personal supervision of Professor Harrison and myself. As far as it could be done, the factors of exposure to light, wind, rain and soil conditions were rendered as nearly alike as possible on the various plots.

The canes upon the plots were reaped on the 28th April 1890, and the three following days, and were at that time just about ripe.

As in the past three years, the canes were weighed, crushed, and the juice measured at the works of Bushy Park plantation, the property of the Rev. Henry Daniel and others, which through the kindness of their attorney, Mr. G. A. Sealy, and their manager, Mr. W. C. Hutson, were placed at my disposal for the completion of the experiments.

RESULTS OF THE CRUSHING OF THE CANES.—NITROGEN SERIES.

MANURING OF THE FOURTEEN PLOTS.	167° F.	60° F.	Juice by Mill per cent.	Per cent. of Sucrose in Canes.	Lbs. per acre of available Sugar in Juice.	Profit or Loss by Manuring upon	
	Imp. Gals. of Juice per acre.	Density Baumé.				No Manure.	No Nitrogen.
						Dols. c.	Dols. c,
No manure	2,967	12·4	58·3	16·02	6,187	....	....
Farmyard manure applied in 1888 .. .. 20 tons.	4,529	12·2	59·7	15·27	8,809	— ·67	— ·33
Cinereals only { Assimilable phos. applied in June .. .. 100 lbs. Potash applied in June .. .. 60 lbs. }	4,294	12·2	61·1	15·89	8,831	+ 33·12	....
Nitrogen as sulphate of ammonia applied in June .. 40 lbs...	6,012	11·3	62·3	15·07	10,939	+ 63·88	+ 30·76
Nitrogen as nitrate of soda applied in June.. .. .. 40 lbs...	5,265	11·3	61·5	14·66	10,044	+ 51·06	+ 17·94
Farmyard manure applied in 1888 .. .. 20 tons. Nitrogen as sulphate ammonia applied in June .. .. 40 lbs.	5,122	11·6	63·1	15·72	9,972	+ 19·38	+ 11·52
Cinereals applied in January .. .. Nitrogen as sulphate ammonia applied in January .. 20 lbs. Nitrogen as sulphate of ammonia applied in June .. 20 lbs.	4,508	11·7	61·7	15·79	9,005	+ 28·29	— 4·83
Cinereals applied in January .. .. Nitrogen as nitrate of soda applied in January .. ..20 lbs. Nitrogen as nitrate of soda applied in June.. .. .. 20 lbs.	4,958	11·9	63·4	15·69	10,020	+ 44·12	+ 11·00
Cinereals applied in June .. .. Nitrogen as sulphate of ammonia applied in June .. 40 lbs.	5,310	12·0	60·5	15·13	10,120	+ 45·06	+ 11·94
Cinereals applied in June .. .. Nitrogen as nitrate of soda applied in June .. .. .. 40 lbs.	5,153	11·6	61·8	15·16	9,578	+ 37·53	+ 4·41
Cinereals applied in June .. .. Nitrogen as sulphate of ammonia applied in June .. 80 lbs.	6,293	11·2	62·1	14·70	11,278	+ 55·03	+ 21·91
Cinereals applied in June .. .. Nitrogen as nitrate of soda applied in June.. .. .. 80 lbs.	5,544	11·6	62·1	15·53	10,618	+ 46·33	+ 13·21
Cinereals applied in January.. .. .. Nitrogen as dried blood applied in January.. .. .. 20 lbs. Nitrogen as sulphate of ammonia applied in June ... 20 lbs.	5,114	11·7	61·6	15·25	9,806	+ 40·15	+ 7·03
Cinereals applied in January.. .. .. Nitrogen as dried blood in January .. ..40 lbs, Nitrogen as sulphate of ammonia applied in June ..40 lbs.	5,159	11·4	60·8	15·08	2,746	+ 31·65	— 1·47

The rainfall during the experiments was very favourable for the development of the canes on all the plots, and especially so for those to which the nitrogenous manures had been applied, as there were no heavy rainfalls during the months directly succeeding the one in which the manures were applied; the loss by drainage of the nitrates was thus greatly reduced.

As the field used for the plots this year was the same as the one used in 1877-1888 and which is the poorest field upon the estate, it was decided to give all the plots a small dressing of farm-yard manure including the one to which no manure was usually applied, and which is still described in this year's tables as having no manure; because as all the plots were similarly treated any difference in the yield per acre between this special plot and any other plot would be due solely to the effect of the manure under investigation. The canes on this plot in spite of the manure were short and small, and although weighing 2 tons 8½ cwts. per acre more than the unmanured plot in 1889, actually gave a smaller quantity of juice per acre owing to the mill extraction in 1889 being greater than in 1890. In the former year the mill extracted 63·3lbs. of juice per 100lbs. of canes, and in the latter 58·3lbs. per 100lbs. Where the canes received farmyard manure at the rate of 20 tons per acre in addition to what was applied to all the plots, there was a marked improvement, the increase being over 2,600lbs. of available sugar per acre; and on a plot similarly manured to this last, and to which an application of sulphate of ammonia containing 40lbs. nitrogen had been applied, there was a further increase of 1,163lbs. of sugar per acre, but this, however, was less than where sulphate of ammonia and nitrate of soda, each supplying 40lbs. nitrogen per acre applied at the same time, had been used alone; but as these last plots have been heavily dressed with pen manure in previous years, there was evidently a considerable amount of plant food still available. The results obtained this year with purely mineral manures were again well marked; the application of superphosphate of lime and sulphate of potash supplying 100lbs. assimilable phosphates, and 60lbs. potash, giving a gain of 2,644lbs. of available sugar per acre upon the unmanured plot, and a few pounds more than the plot to which 20 tons of farm-yard manure had been applied.

Three plots received the whole of their mineral manure, (75lbs. assimilable phosphates and 60lbs. potash) with half of their nitrogen

soon after the canes were planted, each plot receiving the nitrogen applied early in a different form, one as sulphate of ammonia, one as nitrate of soda, and the third as dried blood; the first two received in June an additional 20lbs. of nitrogen per acre in the same form in which it was applied in January; the last received its nitrogen as sulphate of ammonia. In comparing these results it was found that the nitrate of soda headed the list with 10,020lbs. of available sugar per acre, the dried blood and sulphate of ammonia coming next with 9,806lbs. and the plot with sulphate of ammonia alone bringing up the rear with a yield of 9,005lbs. of sugar per acre. These results are not in accordance with those obtained in previous years, nor with those obtained this year with the same and with larger quantities of nitrogen applied at one time, and were due to the fact that the plot to which the sulphate of ammonia was applied had been severely attacked by the insect pest mentioned in the earlier part of the report, and although all the clumps in which the disease was noticed were eliminated, still there were doubtless clumps slightly injured which, although they were not observed at the time the canes were cut, effected the yield per acre to some extent. As much as a tenth of this plot was left uncut and burnt later on. In the annexed table a comparison is made of the yields of sulphate of ammonia and nitrate of soda; and as will be observed, the amounts of available sugar obtained from the plots to which the nitrogen was applied in the form of sulphate of ammonia, have in every year, even including the plot attacked this year by the insect pest, exceeded that obtained from the plots to which the nitrogen was applied as nitrate of soda; but as it would be unfair to include the diseased plot, that and the corresponding nitrate of soda plot have been excluded from the averages given in the table.

The highest apparent profit in the group was, as in 1888, on the plot to which a dressing of 200lbs. of sulphate of ammonia had been applied, and in which there was evidently an appreciable amount of plant food still remaining from a heavy dressing of farm-yard manure applied some years before; the next highest was as in the year mentioned above where sulphate of ammonia supplying 80lbs. of nitrogen was used in conjunction with mineral manures, but as was shown in the report for that year, and for the same reason, this latter result is not what would be usually obtained, and was in a great measure due to the prolonged and very favourable distribution of the rainfall.

COMPARISON OF THE YIELDS WITH SULPHATE OF AMMONIA AND NITRATE OF SODA.

Number of Plots used in Experiments with each Manure.	Manure applied.	Average Yields in lbs. of Available Sugar in Juice per acre.	Excess of Yield in lbs. of Available Sugar by the use of Sulphate of Ammonia.
1886—Nine	Sulphate of Ammonia	2,802	
Five	Nitrate of Soda	2,186	616
1887—Eleven	Sulphate of Ammonia	8,729	
Eleven	Nitrate of Soda	7,480	1,249
1888—Three	Sulphate of Ammonia	7,147	
Three	Nitrate of Soda	6,631	516
1889—Two	Sulphate of Ammonia	6,331	
Two	Nitrate of Soda	5,508	823
1890—Three	Sulphate of Ammonia	10,779	
Three	Nitrate of Soda	10,080	699

RESULTS OF THE CRUSHING OF THE CANES.—PHOSPHATES SERIES.

MANURING OF THE SEVEN PLOTS.	167° F. Imp. gals. of Juice per acre.	60° F. Density Baumé.	Juice by Mill per cent.	Per cent. of Sucrose in Canes.	Lbs. per acre of available Sugar in Juice.	Profit or Loss by Manuring upon no Phosphates in January.	Profit or Loss by Manuring upon no Phosphates in June.
						Dols. c.	Dols. c.
Assimilable Phosphates........None Potash—applied in January........60lbs. Nitrogen—applied in June........60lbs.	5,544	12·0	62·1	16·32	11,095	....	— 1·91
Assimilable Phosphates........None Potash—applied in June........60lbs. Nitrogen—Applied in June........60lbs.	6,051	11·6	62·9	15·57	11,222	+ 1·91	....
Assimilable Phosphates—Applied in January .. 60lbs. Potash—applied in January........60lbs. Nitrogen—applied in June........60lbs.	5,622	11·7	63·9	15·63	10,714	— 8·21	—10·12
Assimilable Phosphates—applied in June...... 86lbs. Potash—applied in June........60lbs. Nitrogen—applied in June........60lbs.	5,397	11·6	62·0	15·68	10,188	—16·23	—18·14
Assimilable Phosphates—applied in June......172lbs. Potash—applied in June........60lbs. Nitrogen—applied in June........60lbs.	5,001	11·4	62·2	15·66	9,393	—13·09	—33·00
Mineral Phosphates—applied in January......140lbs. Potash—applied in January........60lbs. Nitrogen—applied in June........60lbs.	5,566	11·7	62·0	15·25	10,672	— 9·01	—10·92
Mineral Phosphates—applied in January......280lbs. Potash—applied in January........60lbs. Nitrogen—applied in June........60lbs.	5,874	11·5	64·0	15·85	11,021	— 6·45	— 8·36

RESULTS OF THE CRUSHING OF THE CANES.—POTASH SERIES.

	Manuring of the Four Plots.	167° F. Imp. gals. of Juice per acre.	60° F. Density Baumé.	Juice by Mill per cent.	Per cent. of Sucrose in Canes.	Lbs. per acre of Available Sugar in Juice.	Profit by Manuring upon no Potash.
Sulphate of Ammonia = 60lbs. Nitrogen in June.	Potash ....None Assimilable Phosphates ....75lbs.	5,661	11·6	63·4	16·13	10,544	....
	Potash ....30lbs. Assimilable Phosphates ....75lbs.	5,993	11·6	63·6	15·37	11,392	+ 10·98
	Potash ....60lbs. Assimilable Phosphates ....75lbs.	5,973	11·6	63·6	15·50	11,230	+ 6·81
	Potash ....90lbs. Assimilable Phosphates ....75lbs.	6,777	11·4	63·8	15 61	13,167	+ 34·12

GENERAL MANURING OF THE ESTATE.—RESULTS OF THE CRUSHING OF THE CANES.

Manuring of Plot.	167° F. Imperial Gallons of Juice per acre.	60° F. Density Baumé.	Juice by Mill per cent.	84° F. Lbs. of Imperial Gallons of		Per cent. of Sucrose in Canes.	Lbs. per acre of Sucrose in			Gain by the application of all the Cinereals early in lbs. Avail. Sugar.
				Sucrose.	Glucose.		Canes.	Juice.	Available Sugar in Juice.	
All the Cinereals with 20·00lbs. nitrogen in January, balance of nitrogen in June	5,427	11·3	61·8	1·867	·084	14·37	13,344	9,912	9,190	1,011
A portion of the Cinereals with 14·00lbs. nitrogen in January, balance of Cinereals and nitrogen in June	5,013	10·7	60·5	1·798	·087	13·86	12,116	8,817	8,179	....

On referring to the table it will be seen that where no phosphates were used, the plot that received the application of potash in June gave slightly better results than where it was applied soon after the canes were planted in January. This is not in accordance with results previously obtained, and was due to the injury the canes sustained from the insect pest mentioned before. The results with the manurings with phosphates this year although giving excellent yields are not satisfactory, as strange to say, in each case have the applications of phosphates been attended with decreased yields of sugar per acre. The amount of decrease being the greater, the larger the quantities of phosphates used, with the exception of where they were applied as insoluble phosphates, in this instance the plot which received the 280lbs. of insoluble phosphates giving 349lbs. of available sugar per acre more than the plot to which 140lbs. had been applied. Although the experiments in this group are unsatisfactory, still other experimenters have met with similar results as was pointed out in the report for 1887, and have also only recently occurred in Louisiana, U.S.

Experiments with Potash—Group III.

The canes on this group were long, fine healthy ones. Those on the plot to which potash to the amount of 90lbs. per acre had been applied, weighed more per individual cane than those from any other plot on the experimental field. This series of experiments have again this year confirmed the opinion expressed each year since the first year's experiments, viz.: that potash salts on soils such as those at Dodds cause a large increase in the yield per acre; and have this year on the plot which received the largest quantity given the greatest profit.

Experiments with an Early Cane Manure, made to compare the results of applying all the cinereals soon after the canes were planted, and of applying a portion then and the balance in June.

This series of experiments were made upon a field which had been fallowed from cane cultivation since the crop of 1887, and which had undergone the following rotation, 1886, 1887 canes; 1887, Imphee (one of the varieties of the Sorghum saccharatum) followed in 1888 with Wooly Pyrol (Phaseolus Mungo) which was turned in in September; and just before the canes were planted the field received in addition a dressing of farmyard manure at the rate of about 20 tons per acre. After it was thoroughly tilled and drained, on the 27th

November, 1888, about a week before the canes were planted, one plot received an application of an "Early Cane" Manure calculated to supply in round numbers 20lbs. nitrogen, 60lbs. assimilable phosphates and 33lbs. of potash per acre, and later on on the 17th June, 1889, a further supply of 24lbs. nitrogen per acre, and on the 7th of August 20lbs. more making a total of 64lbs. of nitrogen per acre; the other plot received in November 14lbs. nitrogen, 44lbs. assimilable phosphates and 24lbs. of potash per acre, and on the 17th of June in the following year 30lbs nitrogen, 16lbs. assimilable phosphates and 9lbs. of potash, and later on in August a further dressing of 20lbs. of nitrogen, making the total quantities of nitrogen, assimilable phosphates, and potash the same as that given the other plot.

From an early time there was a marked difference in the appearance of the canes, the plot which had received the whole of the mineral manures and a portion of the nitrogen early being decidedly the best, the canes growing with more vigour than those on the other plot, and resulted at the time of reaping in the former giving a yield of over 1000lbs. of sugar per acre more than the latter. As the cost of the manure was the same on each plot this amounted to a distinct gain, with sugar at $2·40 per 100lbs. of £5 per acre (the molasses from the sugar would more than defray any extra cost for manufacture).

SUGAR CANE FROM SEED.

The remarks of Mr. Bovell with regard to the mode of proceeding in the experiments on raising cane from the seed will be found very interesting, and form a valuable supplement to the information which has already appeared in this journal in January and October, 1889 (Vol. XXI., pp. 2, 13, and 540), May, August, September, October, November, and December, 1890 (Vol. XXII., pp. 260, 417, 460, 487, 492, 547, 578, 628, and 646), and January and February, 1890 (Vol. XXIII., pp. 38 and 59), which supply a fairly complete resumé of the subject.

The seedlings found growing in January, 1888, by Overseer J. B. Pilgrim, and which were mentioned in last year's report as having been transplanted in June of the same year, cut up and planted in ten groups in the December following, were in December, 1889, subdivided into the 40 varieties and all the best canes of the 23 best varieties cut up and replanted in rows in a field, where they are now growing under, as far as possible, similar conditions so that they may be tested next year, the remaining 17 varieties being very poor,

were discarded. In accordance with previous experience here and at the Louisiana State Experiment Station, some of the new varieties which appeared the best last year, a fairly wet year, have this year, a very dry one, almost failed.

From December, 1888, to February, 1889, diligent search was made for growing seedlings and for fertile seeds; both quests proved successful and 420 seedlings were obtained; but owing to their extreme delicacy, and to sufficient not been known of their requirements, only 130 reached the stage for planting out; these were allowed to grow until December, 1889, when all that were sufficiently advanced were cut up and replanted, giving 650 plants. The remainder, it is proposed to allow to remain until next December, when all those that appear to be good varieties are to be cut up and replanted. On the 23rd of November, 1889, the spikelets of several arrows were sown in boxes, and after a few days several of the young plants were observed to be springing up; and from then until the middle of the following month several more lots of the spikelets were sown until, with what had been found growing spontaneously in the fields, there were some 2,500 young seedlings. Of these 1,000 have been kept and planted out in one of the fields, the remainder have either been given away or destroyed, as it was found impossible to deal with more than the number kept, owing to the want of level land for plots, &c. Of those given away, nearly 200 were sent to the Royal Gardens, Kew, as well as a "quinine ounce" bottle of seeds and some seeds that had germinated put up in glycerine; in addition to the bottle of seed sent to Kew, 16 other bottles of the same size have been distributed to various botanic gardens and to private individuals who have applied for them. In most instances a small vial containing a few seeds that have germinated were sent as well, so that the recipients might see what a seedling was like even if they did not succeed in growing any of the seeds themselves.

As it may be of interest, the following mode of growing the seeds is here given. As soon as the spikelets are observed to be falling the panicles are cut off, put into thin muslin bags and hung up in a dry place where they can obtain a couple of hours sunshine a day, and as soon as the spikelets appear dry they are rubbed off the panicle and sown in boxes filled with finely sifted garden mould, well watered, and placed in the shade until they commence to germinate, which will be about the fifth day. From this time on, the plantlets may be exposed to the sun for a short time each day, but great care must be

taken at this period of their growth not to expose them for more than about half-an-hour, as it is found that a longer exposure does more harm than good. Great care must also be taken in watering them: water falling from the smallest size watering pot held a few inches above the box being sufficient to wash them out of the soil. A teaspoon answers better than any thing else that has been tried for watering them. A teaspoonful of water given morning and evening being found quite sufficient when the seedlings are very young.

THE PRESERVATION AND ANALYSIS OF SUGAR SOLUTIONS.

By HUBERT EDSON.

(From the *Journal of Analytical Chemistry*.)

In 1871, C. Houghton Gill pointed out the presence of an error in the examination of low grade sugars and molasses due to the compound formed by the invert sugar with basic lead acetate. To illustrate the amount of this error some of his experiments are given below:—

15 cc. of a solution of invert sugar made up to 50 cc. by water	Read —28·25 at 24° C.
15 cc. of same solution with water and 2 cc. of saturated solution of basic lead acetate to 50 cc.	Read —24·7 at 24° C.
15 cc. of same solution of basic lead acetate solution alone to 50 cc.	Read +57 at 25° C.

This alteration of the rotatory power affects only the levulose of the solution, the dextrose retaining its normal effect on the polarised ray.

A solution of nearly pure levulose, prepared by Dubrunfaut's method, and reading—44 at 20° C. made up to two vols. by solution of basic lead acetate	Read —6 at 20° C.
A solution of pure dextrose, prepared from invert sugar, and reading 60·3, made up to two vols. by strong solution of basic lead acetate	Read 30·5

Gill corrected this optical error by the addition of a solution of sulphur dioxide to acidity, thus breaking up the levulose compound which cannot exist in an acid solution.

These experiments were overlooked by sugar chemists for several

years, the use of basic lead acetate being continued as a clarifying agent without acidifying the solution to destroy the levulose compound. Last year, however, Mr. G. L. Spencer of the U. S. Department of Agriculture, recalled attention to them and also made many experiments himself which corroborated the results of Gill in almost every particular, he using acetic acid to acidify the solution instead of sulphur dioxide. Mr. Spencer secured very accurate polariscope work and developed a method of analysis which has proved to be of great value in examinations of raw sugars and molasses.

Besides being used as a clarifying agent, basic acetate of lead is also used as a preservative of sugar solutions. This is done mostly where raw juices are worked and where there is not time to analyse samples immediately on coming into the laboratory. From solutions preserved in this way, both sucrose and invert sugar are to be determined. It was from certain peculiarities in the amount of invert sugar secured that led me, last winter on Calumet Sugar Plantation, La., to investigate as thoroughly as I could, with the apparatus there, the effect of basic lead acetate on a solution in which invert sugar is to be determined, and I am now prepared to state the results are unreliable. Below are some of the representative analyses I have made on the work :—

	GLUCOSE.		
	Basic Lead Acetate Added.	Basic Lead Acetate and Acetic Acid Added.	No Lead or Acetic Acid Added.
	Per cent.	Per cent.	Per cent.
Clarified juices	0·92	1·13	1·17
Syrup	2·99	3·49	3·76
First Masse cuite	5·66	6·71	6·91
,, ,,	5·47	6·50	6·35
,, ,,	6·39	6·25	7·04
Second ,,	11·67	13·72	14·06
,, ,,	14·86	17·73	17·29
,, ,,	13·56	14·54	15·65
,, ,,	13·54	15·21	15·47
,, ,,	12·97	15·31	15·82
Final molasses	17·54	20·15	20·93
,, ,,	17·28	18·76	20·56
,, ,,	16·87	19·04	20·45

These analyses were made with the greatest possible care, and yet it is seen that no regularity even exists in the results. The method pursued in the examination was as follows :—

Three samples were weighed out, care being taken to have the same amount in each case. To the first was added basic lead acetate solution, made up to known volume, filtered, and aliquot portion taken, excess of lead precipitated, solution made up to known volume, filtered, and reducing sugars determined by Violette's modification of Fehling's solution.

To the second sample basic lead acetate and acetic acid to acidity were added, solution made up as in the first, lead precipitated, solution neutralised and diluted to same volume as first, and reducing sugars determined.

The third sample had no lead or acetic acid added, but was made up to the volume in the same manner as the other samples.

This last was taken as the standard and the others compared with it. The first method gives an enormous error, amounting to about 20 per cent. of the reducing sugars present. Much work, especially in sugar houses, has in the past been done by this method and consequently is useless in comparison with results now obtained, though fortunately, such results are fairly comparable with each other.

The second method, in which acetic acid is added to the solution after the basic lead acetate, is much nearer correct. The main difficulty with it is its unreliability, the results sometimes being too high and then again too low. They are in the main too low by from eight to two-tenths of one per cent. in samples containing comparatively large amounts of reducing sugars, and nearer the low error in samples containing a small amount of these sugars. Accurate determinations of reducing sugars cannot be secured from either of the above methods.

Having proved the existence of an error when basic lead acetate was used, it became necessary to find some other reagent to take its place. The idea in adding acetic acid to basic lead acetate solution was, of course, to convert the lead oxide combined with the levulose into an acetate and leave the levulose in solution uncombined. Now when this has in the end to be done, there is no reason why the normal acetate should not be used in the first place, as the lead, in combining with the impurities present in a sugar solution, frees enough acetic acid to prevent the levulose compound being formed.

There were three essential things which the normal lead acetate had to accomplish to fill the requirements of sugar work. These were a good clarification, preservation of juices, and non-interference with correct analytical results. In the first of these it is most defective, but serves equally as well as the basic acetate after acetic acid has been added to the solution; and as nothing approximating accurate results can be secured by the latter without the use of acetic acid, the two are on an equality at this point.

In regard to the preservation of juices unaltered, I measured out duplicate samples of a juice, the per cent. solids of which was 15, added normal lead acetate to each, determined the reducing sugars in one immediately and allowed the other to stand one hundred hours before the determination was made. In the first 1·124 per cent. of reducing sugars were found, and in the second 1·120, or a difference of only four one thousandths of one per cent. The polariscope reading on the same sample which was at first 24·475, average of four readings, was at the end of one hundred and forty-two hours 24·5, average of same number of readings. Reduced to percentages of sucrose these are respectively 12·238 and 12·25, a difference of twelve one-thousandths of one per cent.

As to the last requisite of the normal acetate, *i.e.*, non-interference with analytical work, a table is given below showing its influence on the determination of reducing sugars :—

	GLUCOSE.	
	Normal Lead Acetate Added.	No Lead Added.
	Per cent.	Per cent.
Clarified juice	1·15	1·17
,, ,,	1·12	1·13
Syrup	3·76	3·79
Final molasses	17·45	17·50
,, ,,	27·04	27·08

These samples were examined in the same manner as the basic lead acetate solutions. There is in each case a slightly less percentage of invert sugar shown in the normal lead acetate solutions than in the juice to which no lead had been added, but even in the molasses this does not in any case amount to more than five one-hundreths of one per cent., and can be entirely disregarded in most all sugar work.

There is a slight error in the polariscopic work which is corrected by the addition of a little acetic acid at the time of analysis.

We may conclude then that the normal lead acetate simplifies the work, and that we can insure correct determination of invert sugar from solutions in which it has been used; a thing that cannot be done where basic lead acetate is the clarifying agent.

SEREH IN QUEENSLAND.

To the Editor of the Queenslander.

Sir,—Your agricultural paragraph in the *Queenslander*, of 27th December, describing the new cane disease sereh, is a nice shell to drop into the camp of harassed planters, who at this time of the year are undecided whether to continue the fight or throw up the sponge. We have all read of the terrible havoc it has made in the crops in Java, and of the extreme measures and expense incurred in trying to eradicate the disease, but I never before now noticed a description of the disease by which I could recognise it. Yet I have seen it in our cane fields for the past four years, and fully expected it to be the same disease sereh, and now after your description I fear many people will tell you of its existence in Queensland, and I should have done so long before this but for the ill effects of such reports on a depressed industry. The disease appears to me to be analogous to the disease known as "finger and toe" in turnips, and might be caused by more evils than one—in fact, anything that prevents or retards a healthy growth naturally induces abnormal growth, whether it be excessive heat with insufficient moisture, a hard crust on the surface of the soil (caused by the sun after heavy rains), a condition that the land readily takes after years of continual cropping, or, what is most probable, the absence of an element in the soil essential to the growth of healthy cane. The Java planters think change of plants from great distance the only remedy, and I think overlook the true cause. I would prefer a good and reliable analysis of the soil, or experiment with various manures and lessening the evil effects of unfavourable conditions of season. To do this effectually irrigation will be necessary, for unless we can keep the degree of moisture necessary for healthy and continuous growth, the benefit of manure will be almost *nil*. Nature allows no rest, and crops to be healthy must be kept growing, and all conditions of seasons unfavourable to growth pro-

duce stagnation, yet the functions of plant life are continued, producing abnormal growth in the form of one kind of disease or another. I hope this notice will not alarm any one or cause our legislators to appoint a Royal Commission of old women to discover the cause of "sereh," because their finding will be (as in the rust disease) "caused by defective cultivation"—or the soil asking for more rational treatment. I am afraid that there are not many planters in the position to respond to this call of Nature, most of us being as poor as cultivators of the soil ought to be, and as poor as our legislators intended to make us when they made laws to lessen our (to them) too great gains. We are retiring from our troubles one by one, and those who are taking our places are depending more on Government aid than on private enterprise, and I hope they will be able to worry the Government to provide a good irrigation scheme, without which I fear you will hear plenty more of "sereh."

I am, Sir, &c.,

AGRICOLA.

Mackay, 31st December, 1890.

PORTO RICO.

The British Consular report on the trade and commerce of Porto Rico for the year 1889 has just appeared, rather late in the day, as the Acting-Consul, Mr. Latimer, admits. The report says—"The export of sugar, as compared with that of the preceding year, shows an increase of 1,623 tons (63,610 tons, as compared with 61,987 tons for 1888), but a decrease in value, as compared with the five preceding years, of £198,738. The increase in value over 1888 was, however, £21,099, which, at equal prices, is almost exactly equivalent to the increase in quantity. Of the total exports of 63,610 tons, 38,742 tons, or somewhat over one-half, went to the United States; 14,039 tons to Spain; England and the Colonies, 9,002 tons; the remainder to Denmark and her possessions, and Cuba. Out of a total of 648 tons of sugar and general machinery, 453 tons came from England; 110 tons from Spain; 32 tons from France; and from Germany, the United States, and the Danish possessions, less than 20 tons each. Of railway material, nearly the whole, viz., 2,207 tons, came from Belgium, only eight tons from France. Of a total of 78 tons of ploughs, England supplied 44 tons, and the United States 14 tons.

RESULTS OBTAINED AT THE LOUISIANA SUGAR EXPERIMENT STATION.

From the *Louisiana Planter.*

Physiological Plat.

In this plat were conducted experiments to test the following questions:—

1. What distance apart shall we give our cane rows?
2. What part of the cane is best to plant?
3. What amount of seed is required for best results?
4. Does cutting the cane injure it?
5. Is stubble or plant cane best for seed?

This plat was planted October 30th and 31st, and November 4th and 5th, 1889, in rows, six feet apart, except in first series of questions. Each row received seventeen pounds of a fertilizer specially prepared for this plat. It was cultivated in usual way, and laid by June 26th and 27th.

To determine the first question—

What distance apart shall Cane Rows be?

Rows were laid off three, four, five, six, seven, and eight feet, and three taken for each experiment. These rows were exactly one-half acre in length. They were planted with our home striped or ribbon cane, using three running stalks. It germinated well in January, was cut down by the cold in March, but soon recovered. On May 17th all the stalks on each experiment were carefully counted, and at harvest every stalk was again counted and the cane weighed. Each experiment was separately worked up in the sugar house, and careful analyses of the juices made in the laboratory.

Below are appended the results. *(See Table I.)*

A study of the above reveals the fact that in favourable seasons many stalks, after attaining considerable size, perish by over-crowding. This was quite apparent at harvest in the three and four-foot rows by the frequent occurrence of perfectly dead stalks several feet long. This table also tells the tale of destruction in a most convincing manner.

The three and four-foot rows were prostrated by the blow of August 18th, and never afterward recovered. The rest of the p

was but slightly injured. This prostration caused many stalks to die. Since then these experiments have not had a fair showing with the plat. The results are similar to those obtained previously, though in diminished quantities. The three-foot rows have given the largest yield and the heaviest stalk, followed closely by the five and four-foot rows. The increase of the three-foot rows over the eight-foot is barely six tons—about enough to cover the increased seed required to plant the former, while the five-foot rows give an increase sufficient to cover the increased seed and very fair profit besides (over three tons per acre).

It may be remarked that the three and four-foot rows received no cultivation after April 14th, the cultivator used for the rest of the crop being too wide for these rows.

The above experiments are not so impressive in their results as those of previous years, yet they plainly declare in favour of narrowing our rows. Any planter is safe in adopting five-foot rows, and upon these the two-horse cultivators can be successfully used.

What part of the Cane is best to Plant?

Is the second question in the physiological plat. To answer this, selected stalks of cane were cut into two and three parts, *i.e.*, tops and butts, and tops, middles and butts. Each were planted separately, and three rows taken for each experiment. The ribbon cane was used for seed. The following are the results. *(See Table II.)*

The experiment in the upper thirds of the cane is, from some cause, behind the others. An old road formerly crossed the plat, and perhaps this may in part account for the loss of stalks between May and December.

Enough is shown, however, in the above to confirm previous deductions that the upper part of the cane was equal, if not the superior, to any other portion for seed. Some day when the agriculture of cane shall be disconnected from the manufacture, the upper thirds of all canes will be planted, and the rest, at an increased price, will go to the central factory. The third and fourth questions are construed in our experiments. The question—*what number of stalks shall be planted?* is duplicated in cut and uncut canes. Fortunately, last year, the cane was straight, and could be planted without using the knife. This year, a repetition of this experiment is denied by the intense crookedness of the cane. In the first series the entire cane

was planted "uncut," and in the second it was cut into lengths of twelve to eighteen inches. Purple cane was used for seed. The following are the results. *(See Table III.)*

To plant an acre, one stalk continuously, there are required about two tons of cane, four tons for two stalks, six tons for three, and eight for four. Remembering this, it will be seen from above that there has been no profit in planting four or even three stalks. As heretofore announced, with good cane two stalks are sufficient to insure the largest returns. Upon good lands one stalk uncut may give excellent returns. The second question, judging from the results of this year, are most positively assured. In every instance, the uncut has given a larger tonnage with a larger stalk than the cut, and, in all but one, a larger sugar content. In the spring, the uncut showed a superior height over the cut, and this superiority was visibly maintained up to the prostration of the cane in September.

Judging from these experiments, cutting cane should be avoided as far as possible, and the knife used only to secure horizontal positions for the cane.

The last series in the physiological plat seeks to solve the merits of plant and stubble for seed. Selected plant cane was used on the first experiment; selected first year stubble on the second; ordinary second year stubble on the third, and small third year stubble coming from planting made the year the station was established near Kenner. These were planted under the same conditions, but in this spring it was found necessary to extend a ditch through this part of the plat to drain other plats nearer the river. It passed through the first year stubble, eliminating two rows, and leaving only one, and this at a good distance from the ditch. The results of this experiment are based on one row, and are probably too high. The following are the results. *(See Table IV.)*

The above confirm previous results that stubble cane is the equal if not the superior of plant cane, for seed.

Perhaps this may be accounted for by closely studying the history of cane planting. For years cane has been propagated by planting the tops of stubble cane, and may not this custom have superinduced in the cane a stronger vitality in the tops over the butts and in the stubble over the plant? We answer "selection" and "inherited habit" may fully account for the fact, if indeed it may yet be called a fact.

TABLE I.—EXPERIMENTS IN DIFFERENT WIDTHS OF ROWS IN PLANT CANE FOR 1890.

KIND OF EXPERIMENT.	Number of stalks May 17th.	Number of stalks harvested.	Weight of cane in pounds.	Average weight of a stalk.	Number of stalks per acre.	Tons per acre.	ANALYSES OF JUICE.				
							Total solids	Sucrose.	Glucose.	Glucose ratio.	Purity coefficient.
3 rows 3 feet wide......	1177	555	1848	3·33	25,900	43·12	13·0	10·00	1·67	16·7	76·9
3 ,, 4 ,, ...	1156	784	2408	3·10	27,440	42·14	12·5	9·30	1·69	18·1	74·4
3 ,, 5 ,, ...	1292	917	3034	3·31	25,976	42·47	13·5	10·45	1·61	15·4	77·4
3 ,, 6 ,, ...	1207	1095	3300	3·01	25,550	38·50	13·3	10·20	1·67	16·3	76·6
3 ,, 7 ,, ...	1396	1308	3766	2·88	26,160	37·66	13·3	10·00	1·47	14·7	75·1
3 ,, 8 ,, ...	1382	1420	4244	2·98	24,850	37·13	12·8	9·60	1·48	15·3	75·0

TABLE II.—EXPERIMENTS IN PLANTING DIFFERENT PARTS OF THE CANE.

KIND PLANTED.	Number of stalks May 17th.	Number of stalks harvested.	Weight of cane in pounds.	Average weight of a stalk.	Tons per acre.	ANALYSES OF JUICE.				
						Total solids	Sucrose.	Glucose.	Glucose ratio.	Purity coefficient.
3 rows, upper half.....	1451	1364	3866	2·83	45·10	12·3	9·30	1·67	17·9	75·8
3 ,, lower half......	1403	1211	3686	3·04	43·00	12·7	9·60	1·64	17·0	75·5
3 ,, upper third	1379	1065	3018	2·83	35·21	12·4	9·50	1·72	17·1	76·6
3 ,, middle third	1184	1281	3322	2·60	38·82	12·3	9·00	1·89	21·0	73·0
3 ,, lower third	1487	1309	3514	2·68	41·02	13·3	9·15	1·67	18·2	68·8

TABLE III.—EXPERIMENTS IN PLANTING DIFFERENT NUMBER OF STALKS "UNCUT AND CUT."

How Planted.	Number of stalks May 17th.	Number of stalks harvested.	Weight of cane in pounds.	Average weight of a stalk.	Number of stalks per acre.	Tons per acre.	Analyses of Juice.				
							Total solids	Sucrose.	Glucose.	Glucose ratio.	Purity coefficient.
1 stalk uncut	749	1065	3260	3·06	24,840	38·01	13·2	9·20	1·62	17·6	69·7
1 ,, cut	641	1180	3248	2·80	27,580	37·87	12·4	9·00	1·56	17·3	72·5
2 stalks uncut	909	1200	3698	3·08	28,000	43·14	13·4	9·90	1·56	15·7	73·8
2 ,, cut	775	1180	3208	2·72	27,580	31·42	12·2	8·65	1·57	18·0	70·9
3 ,, uncut	1378	1257	3722	2·91	29,330	43·42	13·4	10·05	1·43	14·2	75·0
3 ,, cut	997	1240	3080	2·48	28,910	35·93	13·3	9·90	1·51	15·2	74·4
4 ,, uncut	1511	1282	3900	3·04	29,890	45·50	13·4	9·50	1·71	18·0	70·8
4 ,, cut	1279	1324	3676	2·70	30,870	42·91	13·6	9·75	1·71	17·5	71·6

TABLE IV.—WHICH IS THE BEST SEED, PLANT OR STUBBLE CANE?

Plant	1552	1342	3417	2·54	31,290	39·86	14·5	11·00	1·47	13·3	75·8
First year stubble	1029	1449	4248	2·93	33,810	49·56	15·0	11·55	1·35	11·6	77·0
Second year stubble	1030	1281	3345	2·61	33,390	39·02	13·6	10·20	1·56	15·2	75·0
Third year stubble......	1296	1207	3105	2·49	28,210	35·23	13·3	10·05	1·67	16·6	74·7

The following facts have been established with regard to the growth and development of nearly 70 so-called varieties of cane which have been successfully grown during about three years out of over 100 varieties received from different parts of the world:—

1. The facility with which a variety changes its apparent characteristics under changed conditions of soil and climate. When a foreign variety is received, it is carefully examined and its characteristic features noted in a record book. At the harvest each season, another similar but more extended record is made. A comparison of these records alone would fail to identify most of the varieties under cultivation here. This is notably the case with white canes—all having a tendency here to assume more or less a coloured appearance. This is particularly accounted for by the difference in maturity between the foreign cane received and its progeny here.

2. The tendency of most varieties to redden in colour, particularly when stripped of their leaves and on the sunny side of the stalk. Once, early in October, samples of every variety were carefully cut and minutely examined. The peculiar characteristics of each kind recorded. At the same time a few standing stalks of each variety were carefully stripped of the lower leaves and left till December fully exposed to the weather and sun. Their properties were again recorded. In many instances the most apparent properties, such as colour, prominence of eyes, etc., had completely changed. The change of colour is always toward red.

3. Frequently canes, when first received of widely different characteristics, have, by constant cultivation, gradually gravitated toward each other in general appearance, and to-day it is quite difficult to distinguish between them. This is particularly the case with the lighter coloured varieties.

4. The gradual diminution in size and increase of sugar content of almost every variety while undergoing acclimation.

5. The power of resisting the prostrating effects of the storms so usual here in the fall, and which frequently injure seriously our home grown or acclimated varieties. This property may be greatly modified or perhaps eliminated by acclimation.

6. The impossibility of determining the value of a cane by a few years of cultivation here. This is rendered more apparent each year, Several canes which were very unpromising the first year or two, are by acclimation yearly improving and may ultimately be useful, and *vice versa*.

YIELD AND ANALYSES OF VARIETIES OF CANE CROWN ON SUGAR EXPERIMENT STATION, NEW ORLEANS, 1890—HARVESTED 9TH, 10TH, AND 11TH DECEMBER.

Name of the Variety.	Locality whence obtained.	Kind of Cane Planted.	Stalks per Row used in Planting.	Yield in Tons per Acre.	Analyses. Per cent. of Extraction.	Total Solids.	Sucrose.	Glucose.	Solids not Sugar.
Beltran	Louisiana	Stubble	50	51·45	63·8	15·30	12·10	·98	2·22
Beltran	Do.	Plant	25	40·74	70·3	13·00	9·60	1·28	2·12
La Pice	Do.	Stubble	50	45·78	72·5	13·40	9·90	1·15	2·35
La Pice	Do.	Plant	25	37·38	68·4	12·80	9·10	1·51	2·19
Tibboo Merd	Manila	Stubble	50	51·14	70·2	13·30	9·75	1·50	2·05
Tibboo Merd	Do.	Plant	25	38·37	71·2	12·20	8·40	1·67	2·13
Le Sassier	Louisiana	Stubble	50	33·81	70·0	12·00	8·70	1·52	1·78
Le Sassier	Do.	Plant	25	32·65	71·1	12·90	9·20	1·33	2·37
Bourbon	Trinidad	Stubble	50	48·09	73·90	13·10	9·90	1·61	1·59
Bourbon	Do.	Plant	25	41·89	73·10	13·80	9·50	1·72	2·58
Crystallina	Cuba (Otaheite)	Stubble	50	45·67	71·30	12·80	8·50	1·79	2·57
Crystallina	Do. do.	Plant	25	35·91	71·00	12·20	8·00	1·67	2·53
Green	Do.	Stubble	50	47·98	71·20	14·10	10·10	1·47	2·53
Green	Do.	Plant	25	38·64	71·40	12·40	8·20	1·72	2·48
Yellow	Do.	Stubble	50	43·78	70·40	13·00	8·10	2·00	2·90
Yellow	Do.	Plant	25	37·64	72·70	12·90	7·90	2·80	2·20
Otaheite	Do. (Otaheite)	Stubble	50	50·29	72·40	13·20	8·20	2·32	2·78
Otaheite	Do. do.	Plant	25	44·32	79·50	13·80	8·60	2·51	2·69
Portier	Do. (Mauritius)	Stubble	50	52·39	77·00	13·10	8·50	2·50	2·00
Portier	Do. do.	Plant	25	48·68	75·80	13·10	7·80	2·52	2·78
Loucier	Do. do.	Stubble	50	44·20	72·10	13·80	7·70	2·63	3·47
Loucier	Do. do.	Plant	25	40·11	72·00	13·00	7·80	2·38	2·82
Lahaina	Hawaii	Plant	25	58·23	77·50	12·00	8·70	2·07	1·23
Lahaina	Do.	Stubble	12	20·11	79·80	13·50	7·30	2·27	3·93
Caledonia Queen	Queensland	Plant	25	47·78	75·80	12·40	7·50	2·17	2·73
Caledonia Queen	Do.	Stubble	8	30·14	77·30	13·10	8·40	2·08	2·62
Creole	Louisiana	Stubble	50	26·88	73·50	11·40	6·90	1·56	2·94
Creole	Do.	Plant	25	14·91	74·10	10·00	5·50	1·47	3·03
Papuha	Hawaii	Plant	25	46·57	68·40	15·20	11·10	1·00	3·10
Papuha	Do.	Stubble	18	58·91	74·60	12·90	8·90	1·25	2·75
Uwala	Do.	Plant	25	34·96	71·20	9·70	4·20	2·00	3·30
Uwala	Do.	Stubble	39	57·75	75·10	12·80	7·80	1·72	3·28
Kokea	Do.	Plant	25	60·79	72·90	12·60	8·90	1·56	2·14
Kokea	Do.	Stubble	30	37·48	73·80	12·70	8·50	2·50	1·70
Bamboo	Cuba (Mauritius)	Stubble	50	60·27	77·30	13·60	9·20	2·17	2·28
Bamboo	Do. do.	Plant	25	49·81	66·70	13·80	9·00	2·27	2·23
Rose Bamboo	Queensland	Plant	25	41·26	72·70	13·50	8·00	2·38	3·12
Rose Bamboo	Do.	Stubble	8	29·61	74·60	14·20	8·70	2·50	3·00
Mexican Striped	Mexico	Plant	25	37·68	72·20	13·30	10·10	1·67	1·63
Cypremort Striped	Louisiana	Plant	25	38·50	68·40	13·30	10·20	1·47	1·63
Batavian Striped	Guadeloupe	Plant	10	23·76	73·30	1·350	8·00	2·17	3·33
Ainakea	Mauritius	Plant	25	33·60	72·40	13·80	8·50	2·70	2·60
Ainakea	Do.	Stubble	25	46·62	73·30	13·00	7·80	2·43	2·77
Kanio	Do.	Plant	25	57·12	75·00	13·30	7·80	2·78	2·72
Kanio	Do.	Stubble	19	47·09	77·00	13·10	7·60	2·79	2·71
Alkilolo (light)	Hawaii	Plant	25	47·32	73·10	12·70	7·50	2·77	2·43
Alkilolo (light)	Do.	Stubble	4	....	72·80	11·50	6·10	3·94	2·46
Alkilolo (dark)	Do.	Plant	25	40·18	75·00	12·70	7·70	2·63	2·37
Alkilolo (dark)	Do.	Stubble	23	31·36	72·20	12·70	7·50	2·48	2·72
Manulete	Do.	Plant	25	63·28	73·10	12·70	7·40	2·63	2·67
Manulete	Do.	Stubble	25	35·42	73·20	11·80	6·00	2·63	3·17
Cavengerie	Cuba (Queensland)	Stubble	50	64·96	75·70	12·30	7·50	2·78	2·02
Cavengerie	Do. (do.)	Plant	25	47·48	75·20	11·50	6·10	2·77	2·63
Attamattie	Hawaii (do.)	Plant	25	53·62	75·30	11·60	6·50	2·94	2·16
Attamattie	Do. do.	Stubble	51*	54·60	71·20	11·50	6·40	2·78	2·32
Java Black	Antiqua	Plant	25	39·86	65·20	14·50	11·00	1·47	2·02
Ohia	Hawaii	Plant	25	37·30	70·90	10·40	4·80	2·27	3·33
Ohia	Do.	Stubble	10	....	69·00	13·20	7·90	2·63	2·67
Honuaula	Do.	Plant	25	49·70	73·50	12·60	7·30	2·70	2·60
Honuaula	Do.	Stubble	12	....	72·70	11·20	5·80	2·50	2·90
Papaa	Do.	Plant	25	50·26	77·20	12·10	6·90	2·87	2·33
Papaa	Do.	Stubble	11	....	77·20	13·20	8·20	2·86	1·96
Six best experiments of Purple cane	.....	Plant	..	42·01	70·10	13·90	10·34	1·58	2·08
Six best experiments of Ribbon cane	.....	Plant	..	40·17	72·20	13·10	10·05	1·61	1·44

* Most of these canes were very small.

The *Keni Keni* cane respecting which such favourable reports had been received from other stations and botanical gardens was found to be identical with the Hawaii *Lahaina* variety, which had been cultivated for several years at this station.

DEFECATION BY ELECTROLYSIS,

or

THE APPLICATION OF ELECTRICITY TO THE DEFECATION OF CANE AND BEET JUICE BY THE MAIGROT AND SABATÉS PATENT.

(From the *Revista de Agricultura.*)

Everyone is aware of the important part played by the defecation of the juice in the manufacture of sugar, inasmuch as on this depends the successful working and the greater or less amount and even the quality of the product obtained.

The importance of this operation being so considerable, our readers will not be surprised at our making known to them a process which, in our judgment, is one of the most perfect in securing this defecation, and at the same time increases the yield obtained from the cane.

The fundamental principle of defecation by electrolysis is neither new nor unknown, and is based upon technical principles which are within the reach of the most elementary knowledge.

In fact, everyone knows that when an electric current is passed through a solution of salts, it works upon the salts and decomposes them, the metallic base passing to the negative pole, and the metalloid and oxygen to the positive pole, this result being invariable.

This peculiarity has been applied to art and industry, galvanic plating, the extraction of certain metals, and other operations, which always produce economical and satisfactory results, being based upon the simplicity and regularity of its working.

Messrs. Maigrot and Sabatés have now applied this same principle to the defecation of cane and beet juice, and as was to be expected, the results obtained have fully met the hopes which had been entertained.

These juices are neither more nor less than a solution of sugar and various salts, some of organic and others of mineral origin, in water; thus the electric current, operating on the salts, decomposes them, separating the basic compounds and the acids as we have just said,

and effects a *complete defecation*, as soon as we succeed in isolating these basic compounds from the acids, and causing them to disappear from the juice.

From what has been said, it will be seen that the electric current can effect a true defecation in a complete and easy manner, transforming the juice into (as it were) a simple solution of sugar and water, in which case crystallization will take place with facility and without loss, because the causes which at present produce these losses in the course of manufacture have been removed from the juice, and consequently an increased yield will be the indisputable result, and so much is this the case that every time that a modification in the defecation has resulted in producing a purer decoction, the increase in yield has been immediate; hence the anxiety of manufacturers to obtain the best defecation, as they are certain of a better result from their labours.

In our estimation defecation by electrolysis fulfils all the conditions required; simplicity, economy, facility in handling and in working the necessary apparatus, and above all, *certainty of result*, as we shall proceed to show by comparing the usual process with the electric method.

As has been said, the general composition of cane juice is nothing but a solution of sugar, salts of potash, soda, lime, magnesia and silica, and gums, the salts of potash and soda predominating in the form of carbonates, oxalates, citrates, malates, pectates, &c.

When we employ the ordinary defecation by means of lime, we do nothing more than transform the existing salts into salts of lime with the same organic acids which they had in the juice, the potash and soda bases remaining in a caustic state, all that are insoluble being precipitated along with a certain quantity of gum; consequently there remains in the defecated juice the whole of the potash and soda contained in the primitive juice, together with the soluble salts with lime and magnesia bases and the gum which has been precipitated, plus the excess of lime; *i.e.*, with the present defecation, by means of chalk, all that is effected is a change from one solution of sugar and salts in water to another solution of other salts and sugar, also in water, without anything being gained but a change in the kind of salts, but with the disadvantage of having introduced a caustic base, more prejudicial, as are those of potash and soda, to the crystallization of the sugar than all the other salts which have been eliminated.

It is an undeniable fact, easy of comprehension, that if we take a solution in water of pure sugar, and add to it a quantity relatively large (as compared with that existing in the cane juice) of lime and magnesia salts, and cause it to crystallize, the presence of the lime and magnesia salts alone will not impede the crystallization, and we shall obtain very nearly the whole of the sugar contained in the solution; but if to a similar solution of pure cane sugar we add only small quantities of potash and soda salts, whether combined or separate, when crystallization is effected, we shall remark a very considerable loss in sugar, thus demonstrating in an evident manner that the presence in the juice of earthy bases, lime and magnesia, exercises either no influence or only a slight influence on the crystallization of the sugar, whilst only small quantity of salts with potash and soda bases, interfere in a very remarkable manner with the operation of crystallization, hindering it and producing the large losses which we find at present to occur.

The facts just stated are corroborated in a very evident manner by the composition of the molasses, in which the salts of potash and soda form at least four per cent., predominating over the others.

Let us now see what takes place with the application of electricity to the juice.

Weak currents of electricity passed through the juice produced:—Firstly, decomposition of the salts with soda and potash bases, setting the base and the acid at liberty, carrying the base to the negative electrode, and the acid to the positive. Secondly, no sensible alteration in the salts with lime and magnesia bases. Thirdly, precipitation of the gums, owing to the presence of free acids, all the more so, as to neutralize these free acids the necessary quantity of lime has to be added; consequently, if the electric current removes the soda and potash bases outside of the juice, it is clear and evident, that the juice which has been submitted to the process of electrolysis will be transformed into a solution of sugar and salts with lime bases in water, and as we have shown that the salts with lime and magnesia bases either exercise no influence on the crystallization, or their effect is insignificant, it results that by means of electricity we have obtained a *true defecation*, *i.e.*, the primitive juice has been converted into a decoction, which in undergoing crystallization possesses the same advantages as a solution of pure cane sugar in water, which, as is known, are the most profitable conditions for crystallizing sugar from the juice.

We see then how simple, easy, and certain is the process of defecation of the juice by electrolysis, the principle of which Messrs. Maigrot and Sabatés have availed themselves, succeeding with the appliances belonging to their invention, as far as theory can indicate, in uniting the technical and industrial elements, as we shall show by giving an account of the machinery employed, and the conditions under which it works, which will form the theme of our next article.

We learn from a letter in a previous number of the *Revista de Agricultura*, that the inventors, convinced of the great advantages and the profit of this new process, have resolved to afford planters, and others interested in the progress of the industry of the country, a practical proof of these on a more extended scale than hitherto available. To this end, they have increased their plant and erected a cane mill in the soap and stearine candle factory of Sabatés, Hermanos and Co., situated near the slaughter-house for cattle in this city (Havana), where they will continue their experiments with electrolysis until the end of January. They have also erected, in the same place, a continuous still, with the view of demonstrating that after molasses or impure alcohols have been subjected to the electrolysing process, and all the impurities eliminated, they can make alcohols of all grades, aromatic and rich, such as have never been seen nor tasted hitherto, so that those of 22° C. can also be used in manufacturing liqueurs and also very fine Eau de Cologne.

THE BEET SUGAR INDUSTRY IN AMERICA.

There is a probability that the people who anticipate great results from the domestic beet sugar industry will be grievously disappointed. The wish is not the father to the thought with us, however, but we cannot overlook one important feature of the present condition of the industry, namely, the bounties upon which the producers are depending and which ultimately must be withdrawn. One of the most promising enterprises in beet sugar making is that which has been established at Grand Island, Neb. The capacity of the factory there is 350 tons of beet a day; this is 50 tons more than the capacity of any other beet sugar factory in the country. Great things are expected of the domestic beet industry and especially of the Grand Island Factory, which has received a great deal of free advertising in the newspapers. It is pointed to proudly as an illustration of what can be done by

American energy backed by Government assistance. But it is not generally known that the State of Nebraska gives a bounty of two cents a pound to manufacturers of domestic beet sugar, or that the Grand Island factory was not erected until after the passage of the bounty act. The general belief is that the national bounty is the sole stimulus of the domestic beet industry, whereas every pound of sugar turned out by Nebraska factories during the present season will draw four cents in bounties. Is it wonderful, then, that capital should have been put into the beet sugar manufacture during the past year? Of the chances of the Nebraska beet industry if the state bounty is withdrawn the *Western Merchant* of Omaha, a warm advocate of the policy of protecting domestic sugar producers, says: "It is certain that if this [State] bounty law is repealed the sugar industry will not grow any from its present proportions." This remark has been drawn from the *Merchant* by the recent action of the Farmers' Alliance on the subject of State sugar bounties. At a meeting in Lincoln just before the convening of the State Legislature the Alliance unanimously resolved that the bounty act should be repealed, and since, two bills with that object in view have been introduced in the Legislature. It therefore appears, first, that beet sugar manufacture in Nebraska, of which such great things have been expected, has been stimulated by the State bounty as much as by national bounty; and second, that the State bounty is likely to be withdrawn very soon. There is a chance, of course, that some progress may be made under the national bounty alone, but who can predict how long it will last? Five years hence it may be withdrawn, but say it is continued for ten or even fifteen years, ultimately it must cease, and what will be the prospect of the domestic beet industry then? We wish the chances were favourable for the complete development of domestic sugar production in this country, but would counsel extreme caution on the part of intending investors for many years to come, at least until the continental nations of Europe do away with bounties to their sugar producers. An industry that never exceeded extremely limited proportions during the long period in which protection was afforded by the heavy import duties, cannot in our opinion hope to attain a wide and permanent expansion under bounties, unless the said bounties are made permanent. That there is little chance of even the national bounty being continued for an indefinite period is clearly shown by the action of the Nebraska Farmers' Alliance.—*Merchants' Review.*

THE MOLASSES QUESTION IN CUBA.

A subject which strongly attracts planters' attention at the present moment is what they are to do with their molasses, if no advantageous scheme to introduce these products into the United States in favourable conditions for boilers to work them can be contrived previous to April 1st.

The following case which we refer to give an idea of the difficulties now existing in disposing of this kind of merchandise, was lately reported from Sagua:—

A planter who is not prepared to boil on his estate the molasses produced, endeavoured to place in said market those of first class, and after striving hard, the best offer he was able to obtain did not go over $6 per hhd. of 175 gallons, deliverable at the Boca [which is the shipping place of Sagua la Grande], with a test of 50 degrees warranted.

Expenses on same, to be paid by the planter, exclusive of the export duty and industrial tax, the collection of which has been deferred, are as follows:—

	Dols.
Cooperage	0·10
Freight of empty hhd.	0·23
Cartage of full do.	1·00
Railroad freight	3·00
	4·35

which being deducted from the $6·00 offered, leaves to the planter $1·65 per gallon on 172 gallons of molasses.

Another offer was made to the same planter, consisting in supplying him with the hhds., for the use of which he was to pay $2, and supposing that the molasses fetched $10 per hhd. at the Boca, after deducting expenses, including 50 cents for leakage and interests, the planter would receive only $3·15 on each hhd. providing all the molasses were to test 50°, otherwise a great reduction would be made in the price agreed upon.

What we have just stated is sufficient to make any one understand that in presence of the high prices ruling for cane, the limited yield in juice and the scarcity of labourers, the loss on molasses is unavoidable. It would be different were planters in a situation to establish on their plantations special tanks, wherein to keep their first and second class molasses separately, and a boiling apparatus to con-

vert them into sugar, which would produce a net profit of $8·63 on each hhd. of molasses worked in this manner, as shown by the following estimate :—

	Dols.	Dols.
Fuel	2·97	
Firemen	30	
Sugarmaker	60	
Purging	1·50	
Use of the apparatus	1·00	
Cost of molasses	10·00	
		16·37
60 arrobes sugar at 50 cents	30·00	
Less freight	5·00	
		25·00
Net profit		8·63

The foregoing items show without the least doubt that planters will now be compelled to work their molasses on their own estates, if they wish to avoid the heavy losses they would otherwise sustain, and we hear that the owners of several of the largest central sugar factories on the Island are already contemplating the establishment of all the necessary machinery to carry out this scheme as soon as they possibly can.—*Havana Weekly Report*.

NOTICES OF BOOKS.

DE SEREHZIEKTE, 1889. Door Dr. F. Soltwedel. *f* 1.50.

UIT HET CHEMISCH LABORATORIUM, No. 1–7, 1890. Door H. Winter. *g* 1.50.

OVER SUIKERRIET UIT "ZAAD," 1890. Door Dr. Franz Benecke. Met 23 figuren. *Niet meer voorhanden.*

OVER DE PROEFTUINEN VAN ONS STATION, MET BIJLAGE: Registers der in den proeftuin te Semarang aanwezige Varieteiten, door Emil Rietzschel, 1890. Door Dr. Franz Benecke. *f* 2.50.

OVER DE BORDEAUX-ROODE KLEUR DER SUIKERRIET-WORTELS, 1890. Door Dr. Franz Benecke. Met 8 lithographische figuren en 7 chromo-lithographische figuren. *f* 3.50.

VOORSTEL TOT EEN NIEUWE WIJZE VAN BENAMING DER STEKKEN VAN HET SUIKERRIET, 1890. Door Dr. Franz Benecke. Met 4 figuren op een tafel. *f* 0.70.

OVER HET GEWICHT EN DE UITBREIDING VAN HET WORTELSTELSEL BIJ HET SUIKERRIET. 1890. Door Dr. Franz Benecke. *f* 0.60.

IS HET MOGELIJK UIT TYPISCHE "SEREH"-STEKKEN, GEZOND SUIKERRIET TE TELEN? 1890. Door Dr. Franz Benecke. Met 2 figuren op een tafel. *f* 1.

CHEMISCHE ANALYSEN VAN SUIKERRIET UIT DEN VARIETEITENTUIN TE SEMARANG, 1890. Door P. H. Meulemans. *f* 0.50.

OVER DE JUISTE BENAMING DER GENERATIES VAN SUIKERRIET EN VAN SUIKERRIET-STEKKEN, GETEELD UIT IMPORT-STEKKEN, 1890. Door Dr. Franz Benecke. *f* 0.50.

ABNORMALE VERSCHIJNSELEN BIJ HET SUIKERRIET, 1890. Dr. Franz Benecke. Met 17 figuren op VIII platen. *f* 5.

OVER DE GEVOLGEN VAN VOORTDURENDE VERMENIGVULDIGING DER PHANEROGAMEN LANGS GESLACHTELOOZEN WEG, 1890. Door Dr. M. Mörius. Met eene Voorrede van Dr. Franz Benecke.

G. C. T. VAN DORP EN CO., Semárang (Java).

Readers of this magazine will scarcely need to be reminded of the existence of Dr. Franz Benecke, the successor, at the "Midden-Java" Experimental Station, of the late Dr. F. Soltwedel, the undoubted pioneer (see *Sugar Cane* for December, 1890,) in the discovery, achieved independently and almost simultaneously by Messrs. Harrison and Bovell, in Barbados, of the fact that sugar cane can, like most of the graminaceæ, be propagated by means of its seed.

On pages 90 and 91 of our February number, we gave a short description by Mr. H. Winter, formerly chemist at the West-Java Experimental Station, of the various establishments of that character now existing in the island, and we have for some little time been in possession of the publications detailing the results of the work carried on at those stations, the titles of which are given above, the greater part of which are from the pen of Dr. Franz Benecke above mentioned. It is to be regretted, as was pointed out by Mr. George Stade in his letter of the 10th November, 1890 (see *Sugar Cane* for December), that these useful publications appear only in the Dutch language, as the number of those interested in technical matters of the kind, who are at the same time masters of Dutch, is exceedingly restricted, and if these works are to be as useful and valuable as the writers undoubtedly desire they should be, it will be necessary for them to appear in English, which is now the world's language for international, commercial, and industrial intercourses. It will perhaps be remembered that, in our issue for August, 1890, we reviewed the first

part of the report of the Experimental Station in West-Java, which was published in both Dutch and German, but to be thoroughly useful they should certainly be translated into English.

We have not space for a textual reproduction of the present publications, but propose eventually to supply from time to time translations of the more important parts of some of them, and shall therefore content ourselves for the present with a recapitulation in English of the titles and a few explanatory remarks to each, with an occasional short extract from those more immediately interesting.

The first of the publications now before us is by Dr. Franz Benecke, and is entitled "On Sugar Cane from Seed." We learn by the last mail that the whole edition has been sold out. It is a handy pamphlet of 74 pages with 28 figures, the latter illustrating the history and growth of the seed and young plants up to about 10 weeks old. The letterpress gives a short description of the sugar cane, followed immediately by that of the infloresence and fructification, and then enters on the history of the views put forth by various writers with regard to the fertility of the sugar cane seed, almost all of them apparently holding the opinion that the seed was infertile and incapable of producing plants. This is followed by a resumé of the results obtained by Dr. Soltwedel, and published by him in 1886 and 1887 in the "Tijdschrift voor Land-en Tuinbouw en Bosch-Kultuur," the gist of which has already appeared in our columns in the letter of Mr. H. Winter, and will be found in our December (1890) issue, in fact, the pamphlet now under notice is the one on which Mr. Winter based his communication, and to which he alludes in several parts of his letter. Dr. Benecke was associated with Dr. Soltwedel in a great portion of his labours. The publication may be described as an exhaustive account of what has been known, and thought, and found out about sugar cane seed from the earliest times of which we have any record in this respect—up to, and, of course, including Dr. Soltwedel's discovery and Dr. Benecke's work in full detail—not omitting G. E. Rumphins (1695), who declares that it never bears flowers or seed, though if they allow it to become a few years old, and also if it grows in a stony place, a large plume like that of a reed grows at the top and something like seed appears in it. Bruce's remark (to which we alluded when the question first came under discussion), to the effect that th[illegible] Egypt the canes grew from seed, is also duly noticed.

The pamphlet well deserves the praise given by Mr. Morris, of Kew, when he described it as "a very clear and exhaustive account of the whole matter, illustrated by excellent drawings and sketches of dissections."

The next pamphlet is entitled, "Communications from the Experimental Station, 'Midden-Java,' at Samárang. On the experiment plots of our station, by Dr. Franz Benecke, with contributions from Messrs. G. F. Enger, W. Hasselbach, and Dr. L. Ostermann, and an appendix by Mr. Emil Rietschel."

This pamphlet, of 42 pages, forms an interesting account of the establishment of the station on its present footing, the manner of working, and the difficulties experienced in the work. Naturally a considerable portion of the narrative is devoted to the investigations into the nature of the destructive *sereh* sickness in the cane, the means of arresting its spread, and the possibility by selection of obtaining canes which might be, more or less, proof against it. The results arrived at in this direction seem to have been negative, and the disease has, up to now, baffled the best efforts of the investigators. The plan on which Dr. Benecke arranges the space devoted to experiment, is to divide it into four plots—the varieties plot, for the study of the different kinds of cane; the *sereh* plot, for the study of all the phenomena connected with this disease; the cultivation plot, devoted to essays in improved methods of culture; finally, the disinfection plot, where the question, whether the *sereh* disease can be combatted by disinfection, is being studied. The perusal of this portion and also of the contributions from the other experimental fields connected with this station, produces a very clear impression on the mind, of the orderly, minute, and careful investigation which is being brought to bear on the somewhat intricate problems dealt with, and a tolerably firm conviction that the writers are men who know their work and mean to do it.

"Communications from the Experimental Station 'Midden-Java,' at Samárang. On the Claret-red Colour of the Sugar-cane Root. By Dr. Franz Benecke, with eight lithographic and seven chromolithographic figures."

This is an exceedingly good sample of the minute and painstaking work which is so characteristic of most of the German savants and scientific students. The original intention of the author had been to produce an exhaustive monograph on the root of the sugar cane, the

unfortunate sudden death of Dr. Soltwedel, however, involved so much extra work, that Dr. Benecke had to content himself with the tolerably laborious task of writing nearly 80 pages on the nature and meaning of the claret colour so regularly present in the roots of the sugar cane. Very careful and judicious experiments, patiently and diligently followed up, resulted in answering nearly all the questions which could possibly arise in connection with the phenomenon, and if we give the main conclusions to which Dr. Benecke arrived, we shall probably sufficiently indicate the nature of the experiments and manner of conducting them. The conclusions are as follows:—

1. The occurrence of the claret colour in the tops and the surfaces of the roots of the cultivated sugar cane is undoubtedly dependent on light.

2. There exists no difference between the principal and the secondary roots as regards their property of assuming a claret colour when exposed to light.

3. The greater the intensity of the light that penetrates, the greater also the intensity of the colour.

4. Even a small quantity of light is capable of imparting a red colour to the tops of the roots, the upper surfaces of the roots are less susceptible.

5. That portion of the root which is the closest to the actual top is not red as soon as the root has passed the first stage of its growth.

6. The red colour first appears when the root is growing, consequently it is also dependent on all the factors which are necessary for the growth of a vegetable organ.

7. If the light is taken away from the top of a root, it gradually loses its red colour in its further growth, but may maintain it for days while further growing into the ground.

8. Roots growing under abnormal circumstances do not necessarily assume the claret colour, but may, if it is present, lose the greater portion even in full light.

9. Under favourable circumstances the root tops may already commence to assume a red colour, even after six hours.

10. The sunlight is capable of producing the claret colour by reaction.

Although there are some exceptions, yet in the varieties of the *saccharum officinarum*, it is in any case the rule, that the root tops possess the property of assuming a claret colour when exposed to

light. This colour is not a phenomenon of disease, as there is no trace of micro-organism discoverable in the red cells or in those cells nearest to them. The property of red coloured roots is a common peculiarity in the monocotyledon class. Finally—the claret red of the root of the sugar cane is a phenomenon due to the effect of light, and the object is to defend the vegetation-point, the most important part of a root, from too strong a light.

(*To be continued.*)

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. THOMPSON, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; Angel Row, Nottingham; and 323, High Holborn, London.

ENGLISH.

APPLICATIONS.

581. H. H. LEIGH, London. (Communicated by William Valentine Fry, Peru.) *Process for the defecation of sugar cane juice.* 12th January, 1891.

1040. A. K. BROWN, London. *Improvements in or connected with apparatus for softening and for clarifying liquids.* 20th January, 1891.

1194. A. CHAPMAN, London. *Improvements in multiple effect evaporating apparatus.* 22nd January, 1891.

1296. D. STEWART, Glasgow. *Improvements in sugar cane crushing mills or apparatus.* 24th January, 1891.

1509. H. H. LAKE, London. (Communicated by Edward M. Knight, United States.) *Improvements in filtering apparatus.* (Complete specification.) 27th January, 1891.

1521. H. H. LAKE, London. *Improvements in filtering apparatus.* (Complete specification.) 27th January, 1891.

1697. D. GUELBAUM, Glasgow. *Improvements in evaporation and distillation of liquids.* 30th January, 1891.

IMPORTS AND EXPORTS (UNITED KINGDOM) OF RAW AND REFINED SUGARS.

JANUARY 1ST TO JANUARY 31ST.

Board of Trade Returns.

IMPORTS.

RAW SUGARS.	QUANTITIES.		VALUE.	
	1890.	1891.	1890.	1891.
	Cwts.	Cwts.	£	£
Germany	373,195	291,488	204,961	177,511
Holland	29,686	6,080	14,051	3,461
Belgium	119,259	126,959	52,847	73,775
France	205,266	125,540	122,512	80,350
British West Indies & Guiana	194,646	128,201	154,593	101,512
British East Indies	3,000	11,615	1,760	8,369
China and Hong Kong	....	....	....	....
Mauritius	....	535	....	401
Spanish West India Islands	....	....	....	....
Brazil	35,820	87,531	20,882	53,887
Java	18,000	107,442	14,400	77,480
Philippine Islands	9,200	159,285	4,065	83,219
Peru	98,470	54,321	66,094	37,112
Other Countries	49,803	44,645	34,561	30,788
Total of Raw Sugars	1,136,345	1,143,642	690,726	727,865
Molasses	5,894	18,651	2,382	7,306
Total Sugar and Molasses	....	....	1,458,020	1,292,973
REFINED SUGARS.				
Germany	374,668	333,107	304,668	271,342
Holland	146,633	60,448	122,583	50,190
Belgium	16,065	9,949	14,106	8,194
France	408,838	209,897	323,441	169,526
United States	29	69,610	41	57,590
Other Countries	98	1,200	73	960
Total of Refined	946,331	684,211	764,912	557,802

EXPORTS.—REFINED SUGARS.

	Cwts.	Cwts.	£	£
Sweden and Norway	10,126	1,882	7,158	1,486
Denmark	7,145	9,343	4,141	5,742
Holland	7,145	3,974	5,136	2,898
Belgium	2,865	1,360	1,941	954
France	155	14	112	12
Portugal, Azores, & Madeira	9,081	7,273	6,104	4,938
Italy	11,378	3,870	7,182	2,666
Other Countries	15,772	17,408	11,704	13,347
Total of Exports	63,667	45,124	43,478	32,043

IMPORTS OF FOREIGN REFINED SUGAR.

The British Sugar Refiners' Committee furnish us with the following figures, giving the imports of foreign refined sugar for the month of January, 1891, compared with the corresponding month of the two preceding years, and the average monthly imports for the past year compared with those of 1887, 1888, and 1889, distinguishing the quantities of "Lumps and Loaves" from "other sorts," and giving the separate imports from each country:—

Countries from which Sugar has been imported.	"LUMPS AND LOAVES."							"OTHER SORTS." Including Crushed Loaf, Granulated, Crystallized, &c.							TOTAL.						
	Monthly Average.				Jan.	Jan.	Jan.	Monthly Average.				Jan.	Jan.	Jan.	Monthly Average.				Jan.	Jan.	Jan.
	1887	1888	1889	1890	1889	1890	1891	1887	1888	1889	1890	1889	1890	1891	1887	1888	1889	1890	1889	1890	1891
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France..............	1363	1686	2373	2707	1828	3481	2059	5099	4855	8596	8547	5155	16961	8436	6462	6541	10969	11254	6983	20442	10495
Holland	3780	3267	2294	2858	2510	2970	1289	2483	2675	3354	4580	2535	4362	1733	6263	5942	5648	7438	5045	7332	3022
Germany & Austria ..	1347	1510	2573	2512	2851	2629	1698	10463	11729	13844	18333	21517	16104	14957	11810	13239	16417	20845	24368	18733	16655
Belgium	592	622	827	390	836	647	285	308	227	225	344	367	156	212	900	849	1052	734	1203	803	497
United States	454	8	..	96	..	..	177	2804	157	42	1123	225	1	3303	3258	165	42	1219	225	1	3480
Russia	3	..	23	25	..	..	..	452	1959	2015	29	5226	..	60	455	1959	2038	54	5226	..	60
Other Countries	..	1	239	..	..	..	..	15	2	355	..	..	5	..	15	3	594	..	..	5	..
Total	7539	7094	8329	8588	8025	9727	5508	21624	21604	28431	32956	35025	37589	28701	29163	28698	36760	41544	43050	47316	34209

SUGAR STATISTICS—GREAT BRITAIN.

FOR THE FOUR PRINCIPAL PORTS.

TO FEBRUARY 14TH, 1890 AND 1891.

IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

	STOCKS.		DELIVERIES.		IMPORTS.	
	1891.	1890.	1891.	1890.	1891.	1890.
London	27	.. 46	34	.. 33½	39	.. 28½
Liverpool ..	48½	.. 78	40½	.. 37	35½	.. 23½
Clyde	33	.. 39½	22	.. 23	17½	.. 27½
Bristol	3	.. 3½	8	.. 10	5½	.. 10½
Total ..	111½	167	104½	103½	97½	90

The above figures do not represent accurately, or to the full extent, the position and movements of sugar in the United Kingdom, as Hull, Leith, &c., are not included, there being no published returns for these ports.

SUGAR STATISTICS—UNITED STATES.

(From Willett & Gray's Report.)

FOR THE FOUR PRINCIPAL PORTS. IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND. FOR JANUARY, 1890 AND 1891.

	STOCKS. February 1st.		DELIVERIES. In Jan.		IMPORTS. In Jan.	
	1891.	1890.	1890.	1889.	1890.	1889.
New York	23	.. 2	56	.. 66	57½	.. 57½
Boston	6	.. ..	4½	.. 9	6	.. 9
Philadelphia....	1	.. ..	28	.. 25½	28	.. 25
Baltimore	..	..	1½	.. ..	1½	.. ..
Total......	30	2	90	100½	93	91½

NEW YORK PRICES FOR SUGAR.

From Willett & Gray's Report, February 12th, 1891.

FAIR REFINING.	95o/o CENTFS.	GRANU-LATED.	STAND. A.	STOCK IN FOUR PORTS.
Feb. 12, 1891.—5⅛c.	5¾c.	6½c.	6⅛c.	Jan. 1, 1891— 27,756 tons.
Feb. 6, 1890.—5⅛c.	5⅜c.	6¼c.	6c.	Jan. 1, 1890— 11,169 tons.
Feb. 7, 1889.—4¾c.	5 9-16c.	7c.	6⅝c.	Jan. 1, 1889— 32,254 tons.
Feb. 9, 1888.—4⅝c.	5⅜c.	6⅞c.	6½c.	Jan. 1, 1888— 47,798 tons.
Feb. 10, 1887.—4 9-16c.	5⅛c.	5 11-16-¾c	5 5-16c.	Jan. 1, 1887—102,279 tons.
Feb. 11, 1886.—5⅜c.	6c.	6 7-16c.	6 1-16c.	Jan. 1, 1886— 57,328 tons.
Feb. 12, 1885.—5c.	5⅜c.	6 3-16c.	5⅞c.	Jan. 1, 1885— 89,186 tons.
Feb. 7, 1884.—5⅞c.	6¾c.	7¾c.	7⅝c.	Jan. 1, 1884— 60,900 tons.
Feb. 8, 1883.—6 13-16c.	7½c.	8⅝c.	8¼c.	Jan. 1, 1883— 50,297 tons.
Feb. 9, 1882.—7⅛c.	7¾c.	9 3-16c.	8⅝-¾c.	Jan. 1, 1882— 43,927 tons.

STOCKS OF SUGAR IN THE CHIEF MARKETS OF EUROPE ON THE 31ST JANUARY, 1891, FOR THREE YEARS, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal *entrepôts.*	TOTAL 1890.	TOTAL 1889.	TOTAL 1888.
106	550	310	335	49	25	1375	1400	920

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING 31ST JANUARY, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal *entrepôts.*	TOTAL 1890.	TOTAL 1889.	TOTAL 1888.
1320	524	509	304	61	382	3100	2892	2766

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE PRESENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1890-91. Tons.	1889-90. Tons.	1888-89. Tons.	1887-88. Tons.
German Empire ..	1,325,000 ..	1,264,607 ..	990,604 ..	959,166
France..........	700,000 ..	753,078 ..	466,767 ..	392,824
Austria-Hungary..	760,000 ..	787,989 ..	523,242 ..	428,616
Russia..........	530,000 ..	456,711 ..	526,387 ..	441,342
Belgium	200,000 ..	221,480 ..	145,804 ..	140,742
Holland	65,000 ..	55,813 ..	46,040 ..	39,280
Other Countries..	80,000 ..	80,000 ..	87,000 ..	79,980
Total....	3,660,000	3,619,678	2,785,844	2,481,950

The changes made by Mr. Licht, based on the more definite returns now available, are: France, 60,000 tons less; Austria, 10,000 tons more; Holland, 15,000 tons more; other countries, 5,000 tons more; the net difference, as compared with his January estimate, being 30,000 tons less.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

The market for cane closed very quietly at the end of January, but an improvement gradually sprung up as the month advanced, and values were well maintained. At the moment of writing the market is very firm, full prices being demanded, and the general opinion is that sugars are certain to advance at no very distant date. The idea, which we consider well founded, that the supply will probably not exceed the consumption, is having a steady effect, in spite of the cautious attitude of buyers. In our last we described the position as a strong one, and we see nothing to alter but everything to confirm this view. The advance since our last quotations is, however, only about 3d.

The refined market was dull at the close, but an advance was established in Paris loaves, while some English kinds are slightly cheaper. Cuba centrifugals were firm. Prices of beet advanced rather smartly in the middle of the month, again declined, but close with a decided upward tendency at about 1/- higher than at the end of January.

The eventual effect of the McKinley Tariff forms the greatest and at the same time the most uncertain factor in all calculations as to the ultimate course of prices. Messrs. Willett & Gray, of New York, say, "all prognostication of the future of sugar are hazardous under the McKinley bill."

Present quotations for the standard qualities, as under, are:—

Floating.			Last Month.
Porto Rico, fair to good Refining	13/- to 14/-	against	12/9 to 13/9.
Cuba Centrifugals, 97°/$_o$ polarization	15/-	,,	14/3
Cuba, fair to good Refining	13/- to 13/6	,,	12/9 to 13/3.
Java, No. 14 to 15 D.S.	15/3 to 15/6	,,	15/- to 15/3.
British West India, fair brown	12/9	,,	12/-
Bahia, low to middling brown	11/- to 11/6	,,	11/- to 11/6.
,, Nos. 8 to 9	12/3 to 12/9	,,	12/- to 12/6.
Pernams, regular to superior Americanos.	11/6 to 13/-	,,	11/3 to 12/9.

Landed.			Last Month.
Madras Cane Jaggery	10/3	against	10/- to 10/3
Manila Cebu and Ilo Ilo	10/-	,,	9/9 to 10/-

Paris Loaves, f.o.b.	17/3	against	16/9
Russian Crystals, No. 3, c.i.f.	15/4½	,,	15/-
Titlers	18/-	,,	18/3
Tate's Cubes	20/-	,,	20/-
Beet, German and Austrian, 88%, f.o.b.	13/9	,,	12/8

THE

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☞ The writers alone are responsible for their statements.

All communications to be addressed and all cheques, &c., made payable to "EDWARD SUTTON, EDITOR OF THE SUGAR CANE, MANCHESTER," which address is sufficient.

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It is reported that the proposal to establish a large central factory in Trinidad, which has been initiated by Messrs. Morris & Stylman (American citizens) is being warmly supported by many influential men in the Island.

Messrs. Apezteguia Brothers, owners of the "Constancia" Central Factory at Cienfuegos (Cuba), are said to be contemplating the erection of another factory of the kind. The following is from the *Havana Weekly Report*:—

"According to recent advices from Cienfuegos to the *Boletin Comercial* of this city, Messrs. Apezteguia Brothers are now converting all the molasses produced on their grand central "Constancia" into sugar, by means of a new process just installed by them, and which affords astonishing results, as neither molasses nor second-class sugars are now produced on said plantation, which turns out only first-class staple, of superior quality, with a large yield.

"It is stated that no chemical agent enters into the operation and the sugar is obtained naturally, by mixing the molasses proceeding from the centrifugals, with the cane ground in the first mill.

"This process is said to have been invented by a French chemist Mr. Apezteguia brought from Paris two or three months ago, and steps have been taken to have it registered and patented by the Government.

"It is probable that the example just set by Messrs. Apezteguia to work their molasses themselves will soon be followed by a large number of Cuban Planters."

The French chemist in question is the well-known M. Manoury.

Apropos of the molasses question the above journal, in its issue of the 7th ult., remarks:—

"The new sugar legislation to be enforced in the United States on the 1st of April is to bring the disappearance of the molasses-boiling business, the free entrance of low-grade sugars into the United States being a deadly blow inflicted upon that flourishing industry, and the American markets once closed to their proceeds, Cuban planters will be obliged either to sell their molasses at low prices to the local distillers, or to boil it themselves in order to extract from it the greatest quantity of sugar they can.

"They cannot depend upon its sale to distillers as a sure resource, inasmuch as the exportation of our rum is as yet quite limited, and the accumulation of large stocks would forcibly cause prices to rule much lower than heretofore, and would hardly cover the cost of production and of packing; the establishment of boiling-houses would also afford little advantage to planters on account of the low prices they would obtain for their molasses, and as to boiling it on their own estates, few only can afford to enter into the heavy expenses required to run the business on a large scale; but this latter scheme is the only one that can be adopted with any probability of sufficient success.

"Some relief is being sought by sending Cuban molasses to Martinique. We already last month expressed the opinion that this question of Cuban molasses deserves some consideration by our refiners."

Brazil.—Last month we called attention to this very important country in view of the peculiar political situation. Advices since received by us indicate a greater feeling of security than we should have expected. In Pernambuco the working of the central factories, which got a bad name over here owing to the failure of the first two English undertakings, is considered satisfactory. The causes which led to this failure have no existence in connection with the present establishments. From Bahia we learn that the droughts and the

abolition of slavery, which resulted in the closing of six out of the eight central factories, have caused the suspension of the two others. The exports from this port, which in 1887 were 54,000 tons, fell to 17,000 in 1889.

HOLLAND.—The new Sugar Duties Bill has been passed. The minimum of receipts by the Treasury is fixed, for the years 1892 and 1893, at 8,500,000 florins. Any deficit is to be made up *pro rata* by the manufacturers, if the total of their *prise-en-charge* exceeds 32,000 tons. This amounted last year to 45,000 tons, this year it is expected to reach 55,000 tons, but it is believed that the result of the new law will be to limit the quantity in future to about 32,000 tons.

We hear that Mr. Mirehouse, of the Bristol firm of sugar refiners, who has made experiments with beets grown on his own estate, is credited with the idea of erecting a beet sugar factory.

Advices from Brisbane state that the Queensland production will reach 60,000 or even 65,000 tons, but that the excess quantity over last year (over 20,000 tons) is not expected to produce any adverse effect on prices, as much of the above production is already placed. "For all this," adds one of our correspondents, "our planters are not happy, and see troubles ahead in the labour question."

At the next annual general meeting of the Liverpool Section of the Society of Chemical Industry, a paper will be read by Dr. Gustav Schack-Sommer on "Further Experiments on Home-Grown Sugar," a notice of which we hope to give in our next issue.

We now complete our reports on the working, etc., of German and Austrian factories and refineries, which have been suspended since December, 1890, for want of space. It will be noticed that the announcement of losses, as is natural, come latest. The figures in parentheses represent the capital.

DIVIDENDS DECLARED.

Stuttgart, 4% and 4½%.

Rheinische Aktien Verein für Zuckerfabrikation in Köln (about M. 4,500,000), 3%, payable in April.

Mannheim Refinery, 10%; besides placing M. 20,000 to reserve fund.

Net Profits Shown.

Frankenthal (M. 4,800,000), M. 991,665, of which M. 191,665 goes to reserve fund, the rest being divided amongst the shareholders, equal to about 17% dividend.

Nauen (M. 1,000,000 and loan M. 427,000), M. 41,693.

Losses Declared.

Eilenstedt, M. 115,730, the greater part of which is on the agricultural operations. The reserve fund is M. 150,000.

Görchen (M. 500,000), M. 6,428, raising the total debit balance to M. 117,286.

Güstrow (M. 815,000), M. 3,217, which, added to the adverse balance of former years, makes a total debit balance of M. 208,862.

The new factory at Stendal (capital M. 880,000) is to start work this year.

The idea of founding a large Refinery at Hamburg is abandoned for the present.

The Hallesche Maschinenfabrik pays 35% dividend, in place of 32% as announced in our December issue. Each workman who has been in their employ over three years receives also 105 M. (£5), over two years 70 M., and over one year 35 M. The company has four 3-roller mills on order for Java, the rollers weighing five tons each, also orders for the same mills for other tropical countries.

Austria.

The *Pecek Refinery* pays 5% dividend on its capital of 800,000fl. (£66,500), and carries 4,473fl. (£370) to new account.

The *Ungarische Zucker-Industrie Actien Gesellschaft* (President, Carl Steffen) shows a loss of 92,939fl. It was decided to cover 90,000fl. of this out of the reserve, which still amounts to 660,000fl., or 11% of the share capital. This unfavourable result on the first year had been anticipated.

The large new factory at Temesvar (Hungary), which was intended to be started to work up 10,000 quintals of beets daily, is not now expected to be established.

The large refinery now being erected at Aussig (Bohemia), under the name of "English-Austrian Refining Co., Aussig," to work the Steffen process, is established with English capital, the lowest subscription being 100,000fl. (£8,300).

At *Leitmeritz* (Bohemia) a new factory is in course of being established.

RUSSIA.

Lesmierz (Poland) pays 8% dividend.

The Warsaw factory pays 16½%, which would have been larger but for the large sum stolen from their emyloyé, murdered in a railway carriage.

SWEDEN.

The sugar industry is reported to be prospering; there are six factories in full work (against four last year), and the erection of others is contemplated.

UNITED STATES.

NEW YORK MARKET REPORT.

We extract the following from *Willett and Gray's Weekly Circular*, just received :—

BEET ROOT SUGARS.—Entirely neglected by our buyers, and no purchases for America have been made thus far this month. Europeans can scarcely understand such a market as ours, in which days frequently pass without any sales of raw sugar. They think that business is regular here, and sales at the market price always practicable or counterbids obtainable at all times, but with only one buyer in New York, who buys two-thirds of the total amount used in the United States, there is no competition, and satisfactory business is only practicable when he is in the market at irregular times for a full supply of sugar. At all other times, attempts to sell, by drawing bids, lead to lower prices, as during the present week. Hence the frequent ups and downs of quotations show the condition of the buyers' stock on hand.

REFINED.—All exports from the United States to the United Kingdom will end on April 1st, for some months at least, if not for ever, and soft refined sugar under No. 16 D. S. may be imported from the United Kingdom to a limited extent. The United States at present consumes less than 100,000 tons of such sugars per annum, and our increased consumption will run mainly to granulated sugar probably, in the supply of which it appears quite possible that Germany can compete successfully at times, if not regular. It will take the country until the last of April to settle on to the usual hand-to-mouth basis again for refined sugar, and no positive decisions can be arrived at until after that time.

GERMANY.

Proposed Sugar Legislation.

It is now certain that no further attempt will be made to proceed with the projected new legislation on the Sugar Duties for some little time; indeed, it is beginning to be doubted whether the question will be again brought up during the present session. In view of the debate on the Austro-Hungarian Treaty of Commerce, which is expected to come on in the autumn session, it would seem that the decision respecting the sugar duties might well be postponed, as it undoubtedly would be difficult properly to consider the interests of the two countries as regards the sugar industry apart from the new treaty. The opinion is gaining ground in higher circles that those most interested (*i.e.*, the sugar manufacturers and agriculturists), were right in considering the time very ill-chosen for altering the fiscal laws relating to sugar.

The *Deutsche Zuckerindustrie* considers that the outcome of the more mature consideration, for which this delay will afford opportunity, can only be that an ample protection must be given to the sugar producers, as their prosperity depends not only on themselves, but also on circumstances which lie out of their control and are inimical to their well-being; in other words, that the sugar industry cannot, in face of the international competition, afford to dispense with a protective bounty equal to that hitherto existing. "France—for we are compelled, in referring to the substantial reasons for this view, constantly to recur to this our principal competitor—has now attained the stability of legislation for which the French Government has been zealously striving, that is, the French sugar industry has now obtained the security for a long period of a far higher premium than that which the German manufacturers possess in virtue of the law of 1887, and they are further than ever in France from any intention of adopting the course which the German Government has entered on, and which the latter wanted to justify by pointing to similar action which would shortly follow on the part of countries which are our competitors. We are now certain that this argument is entirely invalid as regards its application to France."

FRANCE.

New Sugar Legislation.

On the 3rd March the Chamber of Deputies finally adopted the Government proposals, the effect of which is to fix the legal yield from the 1st September, 1891, at 7·15% (calculated in refined sugar), the excédants over 7·75% and up to 10·5% being subject to a duty of only 30fr. per 100 kilos. in place of 60fr. Where the yield is over 10·5%, half pays 30fr. and the other half 60fr. In certain cases, an option (which must be claimed five days before commencing work) is allowed, by which a direct premium will be obtained, but it is unnecessary to particularise this, as it is believed very few will avail themselves of it.

The effect of the new legislation, assuming that the yield obtained amounts to 10·5%, will be to give a premium of about 2s. 10d. per cwt. on raw sugar, and it may fairly be supposed that the greater portion of the French manufacturers will attain this yield or a still higher one.

There is every probability that the law, as voted by the Chamber of Deputies, will be confirmed by the Senate. The manufacturers and agriculturists are deeply dissatisfied with this enactment. Had they presented a more decided front, the result might possibly have been more favourable, but the difference of opinion among them was very marked, and they probably have mainly themselves to thank for much of what has befallen them. One of the French journals remarks, that at any rate those interested now know what they have to go upon, and that is about all the good there is in the new law, and not much, it will be admitted.

As regards the not very successful campaign 1890–91, a modification of the present law was made in favour of the manufacturers, on condition that they return to the agriculturists, from whom they purchased the beets, 1fr. 50c. for every 1,000 kilos. worked up. This last condition, it is thought, may not be adopted by the Senate, as it is almost certain to lead to disputes between the two parties.

THE McKINLEY TARIFF.

It is many years since anything has happened in connection with the fiscal legislation of any country that has produced such widely felt effects as has been the case with this last remarkable outcome of American protective policy. One can almost figure the author of the bill as contemplating with somewhat of the feelings of a mischievous schoolboy the scare created by his pranks among the steady going old fogies. Undoubtedly no other country has the power to produce anything like such an impression, because no other country has behind it such an enormous consumption susceptible of almost indefinite expansion. That any country is morally bound, under the present arrangements of the comity of nations, to consult the interest or advantage of any other country to the detriment in the least of its own is a doctrine which we cannot in any way recognise, but it is open to consideration whether the time is not fast approaching when it shall be true of nations as it undoubtedly is already of individuals, that he who seeks exclusively his own aggrandisement will not advance his own true interest in the highest sense. Meanwhile, as we have not got so far yet, we may cheerfully concede that the United States have a perfect right to do what they have done in passing this outrageous measure of protection, doubtful though we may be whether the consumers' interests, which should be paramount, have been intelligently considered. But we shall be permitted at the same time to think that it is highly probable so extreme a measure will bring about in no very great space of time the inevitable reaction which follows all extreme measures.

For our own part we are convinced that the indirect, or, perhaps, it would be better to say the direct, consequences of the McKinley Tariff will be the solving of many commercial problems, the uncertainty respecting which has long stood in the way of true progress. Even a conscientious Free Trader will admit that Protection may under certain circumstances be a good thing; here, however, we have Protection running riot, and the adage is true, *corruptio optimi pessima*. So the convinced Free trader will rather, if anything, be encouraged by this evidently exaggerated outcome of the reasonable desire to protect oneself, and it is more than likely that those who are hankering, under the pressure of hard times and severe competition, after a so-called Fair Trade, the *principle* of which is cer-

tainly that of Protection, may learn a lesson from the rather unfair trade which is being tried over the water.

Meanwhile, as regards our friends in the West Indies, Canada, and other British Colonies, who have much, if not everything, to gain or lose in this matter, they are as characteristically English as any of us; they are clear-headed as regards their own interests, and they may well be trusted to look after things which they understand better than we do. And if the Government will only do their duty and help the Colonists in the intricate arrangements which the tariff will necessitate, and, at the very least, not stand in their way as was unfortunately the case some years ago, when certain very similar arrangements were thought necessary by more than one of the West India Colonies, then we may look forward very cheerfully to the issue. British energy and determination, British clearsightedness and British capital—and we have a right to speak of these, for they still are and seem likely to remain potent factors in the world's development and the world's education—are yet to be reckoned with, and as regards the question of sugar, which more especially concerns this journal, the capabilities of the sugar-cane, unlike those of its rival, the beet, are not yet developed to the maximum of possibility. So whatever we may hear about America producing all the sugar she needs, whether from beet or cane, or the beet sugar of Europe ousting West Indian sugars from the American market, let us remember—"Das spiel ist nicht aus!" There are plenty of moves yet on the board, and courage, coolness, and true comprehension of the position will bring us out of this the latest complication into which protective duties have led the commercial world.

It is, however, true that for the moment no solution can be offered of the very complicated situation. The McKinley Tariff Bill is too uncertain as regards its operations, stirs up too many vexed questions which have for a time been slumbering disregarded, and opens up too many problems and possibilities, to permit any living man, however fortunately placed, well-informed, and sagacious, and withal unprejudiced and impartial, to be able to indicate thus early the best course to be taken.

In our position we must be content with chronicling the various opinions which reach us, and the steps which are being taken in the Colonies and elsewhere in regard to the matter.

As regards the proposals which have been made by the Canadian

Financial Minister for certain arrangements which, it was hoped, would be to the mutual advantage of themselves and the West Indies, the position was perfectly summed up by the letter to the *Times* of the Chairman of the West Indian Committee, and it may be considered as settled that the comparatively undeveloped Canadian Colonies, with their limited population and consequently limited consumption of sugar, cannot under existing circumstances make an equally acceptable bid with that of their powerful neighbours the United States. However much we may desire that some means of *rapprochment* may be found between Canada and the West Indies. it is to be feared the position is too difficult for any immediate solution.

The speeches and despatches of the Governor of Barbadoes, as well as those of Viscount Gormanston, indicate that a possible modification of the existing tariffs, to meet the case as regards Canada and America, is in contemplation. The Demerara *Argosy* thinks that the views which have been expressed have certainly been inspired by the Home Government, and is not by any means satisfied with the idea, This journal says :—

"Anything more prejudicial to the interests of this colony than the instigation by the Secretary of State to open negociations with the Government of the United States based upon the voluntary admission that our tariff of imports is such as will justify the United States in placing our sugar on the suspended list instead of on the free list, we cannot conceive. That, as matter of fact, our tariff is objectionable, or that the United States Government would be in the least likely to regard it as such without some such meddlesome and fatuous interference on the part of the Home Government as that indicated by Lord Gormanston, we emphatically deny. So long as we impose upon its products and manufactures only the same duties as we exact on the products of other countries, the United States will have no right, nor do we believe, would evince any disposition, to taboo our sugar and thereby imperil the very valuable trade in bread-stuffs, provisions, rice, fish, timber and other articles for which this colony affords such a convenient and profitable market. As we suggested before,—what is wanted is a full and ingenuous representation to the United States of the amount and nature of our import duties, the domestic necessity for levying them, and their unquestionable freedom from the taint of protection."

The *Barbados Globe* also seems to think that there is no need for hurry as regards their relations with America, as is indicated in the following remarks:—

"Our tendencies are Canada toward, but the superiority of the United States relations, supposing that the Government at Washington can be convinced that our tariff is free from objection under the McKinley Bill, must be plain to all that are interested in our position as a sugar colony. The fact that America is striving to produce raw sugar sufficient for home consumption need not envelope us in gloom just now. That consummation is in the far future, and as it approaches the increase of the population will push it still further away. Taking everything into account, we must look to the States, and the best thing to be done is to get a representative in personal communication with the financial officers of the United States Government. This is one of the matters in which we cannot too strongly enforce the fact that *bis dat qui cito dat*."

The opinion expressed by the Governor of Barbados of the McKinley Tariff, after stating that he had suggested to the Secretary of State for the Colonies that a copy of their existing customs tariff should be sent to the British Minister at Washington, with the view of eliciting, if possible, some information as to whether it is likely to bring that colony within the scope of the "penal provisions" of the McKinley Bill, is as follows:—"All, therefore, that we can at present say of this remarkable enactment is that it contains a menace of possibilities which, should they ever be realized, would upset all our calculations and introduce confusion and embarrassment into both our commerce and our revenue."

If we may judge from the opening sentence of an address delivered in February by Mr. J. H. Randolph, before the Louisiana Central Agricultural Society, the cane sugar producers of that State are not so much inspirited by the new enactment as to render very likely any proximate large increase of production. Mr. Randolph said:—"In view of the fact that the *price of sugar has become so low* that the present methods prevailing in this State for producing it make it barely profitable to continue its production in the majority of cases, especially among the small planters, it behoves us, who are interested in making our crops remunerative, to devise methods for the greater development of the sugar interests, and to settle upon some better plan than is now pursued by the most of us engaged in that industry."

The effect of the new American legislation on Cuba is indicated by the formation in that island of a large and influential committee to agitate for the conclusion of a reciprocity treaty between Spain and the United States. The idea that the mother country would not receive the proposal favourably has caused considerable feeling among the Cuban planters and merchants, and we are again hearing vague rumours about contemplated annexation by the United States, the autonomy of Cuba, and preparations by the Spanish Government for forcible repression of this growing desire.

The McKinley Bill has also upset the equilibrium of the commercial mind in the Hawaiian Islands, as the advantages secured to them by the hitherto existing treaty will now be lost, and we hear that annexation to the States is being spoken of as desirable.

In Trinidad, a number of the planters have presented an address to the American Consul with the design of correcting the impression that the immigration tax in force there is an "export duty in disguise" which would deprive them of the right of free entry for their sugars under the new Bill.

Finally the disturbance produced by this remarkable enactment is extending to Germany. Reports are current that the President has actually instructed the American Minister in Berlin to ask for the removal of the prohibition of import of American hams and bacon. Without exactly crediting the reports, we may believe there is some foundation for them, and there can be no doubt that the importance of the export of German sugar to America would make this a question which could not be disregarded by the German Government.

THE TESTING OF CANE JUICE.

By H. Winter.

(From *Mededeelingen van het Proefstation Midden-Java te Semarang.*)

It is a known fact that the saccharine content of the mill juice is subject to constant variation, and that in order to obtain an average figure even for a given day twenty or thirty testings must be made, according to the regularity or irregularity of the cane which is being ground. The same may be said of the other juices and syrups obtained during the process of manufacture, but the question is of especial importance in the case of the mill-juice, if the calculation of

yield is to be founded on its saccharine content. The ascertaining of this average figure is however frequently very defectively conducted, especially where the chemist is obliged to do other work, so that he can only make a few testings in a day. I would suggest a method which will somewhat lighten his task, and put him in a position to obtain by means of a single polarisation an average figure for one day. I will first state the method of procedure, and then explain and give figures in proof of it.

An average sample is to be taken every half-hour or every hour from the juice as it runs off, for instance by dipping small quantities out of the trough with a small cup or similar instrument into the sample vessel. The degree Brix of this average sample is to be determined each time by the areometer, and a flask of 50 cc. is to be filled with it up to the mark. Five cc. of acetate of lead are then added, filling the tube up to the second mark, the tube is then closed with a stopper, shaken up, and allowed to stand.

When it is desired to ascertain the average saccharine content, the contents of the whole of the flasks must be poured into a large dry tube or flask and well shaken together for some time. About 100 cc. of this are to be filtered with a covered filter, and the polarisation ascertained as usual.

The average of the different specific gravities is then to be obtained, and from the average figure of polarisation and the degrees Brix the saccharine content is obtained in the usual manner.

The variation in degrees Brix will give an approximate idea of the variation in the quality of the juice, whilst the polarisation, being conducted carefully with plenty of time, will furnish an exact average.

The saving by this method of working will be, in the case of (say) 20 tests—19 filterings, filling, emptying, and cleaning the tubes 19 times, and 19 times six or eight readings off from the polariser.

The taking of the individual samples may be done by any of the hands, and the ascertaining of the degree Brix may also be done with sufficient exactness by any *Mandoer*, as errors of 0·5% Brix cannot have any effect worth considering on the result of the polarisation, and further any errors in the reading off would probably balance one another in the long run. Finally, filling the test tubes and adding the acetate of lead can be sufficiently accurately performed by an intelligent ordinary hand, the chemist satisfying himself, as often as he has an opportunity, that the filling up to the mark is really

accurate. The number of test tubes filled must naturally be the same as that of the tests of specific gravity. The chemist has then only to mix the samples, and filter and polarise the mixture, thus effecting a material lightening of labour where many tests have to be made.

As a proof that by this method the same result is actually obtained as if every individual sample of the juice were separately polarised and the average calculated, I have made the following experiment.

In the testings made from the experiment fields the cane from each plot was separately ground, and the juice separately examined. From each sample of juice on the day appointed for this experiment a 50-55 cc. tube (as described above) was put aside, and the contents of the lot mixed together and polarised. The polarisations obtained were as follows:—15·84, 16·41, 15·61, 15·72, 16·11, 15·34, 16·11, 16·21, the average being 15·92. With the direct experiment the figure obtained was 15·95, the difference being only 0·03, which is practically equivalent to absolute agreement.

In the case of this experiment the four first tubes had stood as long as 24 hours before the average polarisation was made. Two other experiments, each of which related to a single working day, were made, and the result was equally favourable, viz.:—

A. 15·37, 16·83, 16·83, 16·17, 16·59, 15·92, 17·89, 17·14

Average	16·59
By direct experiment	16·61
Difference	0·02

B. 16·94, 16·18, 17·40, 17·41, 17·02, 18·24, 17·44, 18·35, 18·17, 17·83

Average	17·50
By direct experiment	17·49
Difference	0·01

In these cases there are variations between the individual polarisations amounting to as much as 2%, yet the result, as will be seen, agrees exactly.

Glucose.

A further advantage of the above method is that in the same manner the determination of the average amount of glucose can be obtained from the average polarisation-liquid. The lead is removed in the usual manner with soda carbonate, the solution attenuated, strained, and proceeding in the regular way the average for the entire day is obtained. An experiment was made with filtrates of the juice

used in experiment B (above). The determination of glucose in the various samples of juice treated in the usual manner by filtration, with Fehling's solution, gave the following figures :—0·90, 1·20, 0·79, 0·58, 0·65, 0·33, 0·61, 0·39, 0·38, 0·46.

Average..............................	0·63
Actually found....................	0·60
Difference..........................	0·03

which is a perfectly satisfactory agreement.

Considering the great variability of the mill-juice, the application of the above-mentioned method, in which the acid is removed, might not be considered admissible by everyone unless actual proof had been given in figures. It is, however, important that acetate of lead should in each case be added immediately after the sample is taken. This prevents the development of the various organisms, and has a preservative effect. In order to get an idea of the constancy of the juice to which acetate of lead has been added, and to illustrate the matter in hand, the following experiments were made :—

A number of 100 cc. tubes were filled up to the mark with mill-juice of 15° Brix; to this was added 10 cc. of acetate of lead, and they were allowed to stand with the precipitate. The results of the determination of sugar and glucose were—

	Sugar.	Glucose.
On the 1st day..................	11·72	1·55
,, 2nd ,, ...	11·80	1·61
,, 4th ,, ...	11·83	1·72
,, 6th ,, ...	11·91	1·75
,, 8th ,, ...	11·91	1·76
,, 10th ,, ...	11·94	1·78
,, 18th ,, ...	8·27	3·10

As will be seen, there was up to the 10th day a slight steady increase in the saccharine and glucose content, which of course is only apparent, and is probably to be ascribed to the influence of the acetate of lead. By the 18th day, as might be expected, a considerable change had set in.

In the case of another experiment with poorer cane, which certainly did not promise too favourable results, two sets of tubes, A and B, were used, the former being allowed to stand with the acetate of lead precipitate, the latter after the precipitate had been filtered off immediately after settling. The juice was 12·9° Brix. The result of the polarisation was (in percentage)—

		A.	B.
On the 1st day		7·57	7·57
,, 2nd ,,		7·52	7·52
,, 4th ,,		7·54	7·57
,, 6th ,,		7·57	7·57
,, 8th ,,		7·57	7·54
,, 16th ,,		6·63	7·57
,, 19th ,,	a.	7·65	7·57
	b.	7·09	—

From this we see that in both cases, after standing for eight days, the polarisation gave the same result (the hundredths may safely be disregarded). In the case of the B series, where the precipitate had been filtered off, the juice still remained unaltered, even after 19 days. From this we deduce the practical rule, that where the examination of the juice has by accidental circumstances to be deferred for a considerable time, the acetate of lead precipitate should be first filtered off, and then the samples may be allowed to remain untouched for a comparatively long time without any fear of alteration. In order to determine the behaviour of the glucose, three sets of experiments were instituted with the same juice.

A was allowed to stand with the acetate of lead precipitate.
B ,, ,, without ,, ,,
C ,, ,, after it had been filtered, and the lead removed by means of soda carbonate. The precipitate of the latter was previously filtered off before each testing with Fehling's solution.

On the 1st day the glucose content was 2·95%.

		A.	B.	C.
On the 2nd day		3·25	3·25	3·13
,, 4th ,,		3·24	3·38	3·13
,, 6th ,,		..	..	3·13
,, 8th ,,		3·34	3·33	3·35
,, 16th ,,		3·73	3·48	3·57
,, 19th ,,	a	3·57	3·62	3·57
	b	3·62	..	.

We see that the C series gave the best results. The difference of 0·18% between the first and second day is of no moment in the case of such poor juice.

If, therefore, for any reason it is desired in an exceptional case to defer the determination of the glucose, the lead must be previously got rid of. Such a case may occur in the evening, when it has become too dark for the chemist to effect the titration with Fehling's solution, which can only be done by daylight.

The examples given will, I hope, suffice to remove any doubts as to the efficacy and practicability of the method proposed.

HAWAIIAN ISLANDS.

MILL REPORT OF THE PAAUHAU PLANTATION.

The following is a statement of the work done at Paauhau Plantation Co., Ltd., during the past year:—

The mill has 26in. by 54in. rolls, is of Glasgow make, and was erected in 1879, and is by no means a first class modern mill.

The lands of the plantation are as steep as any used for cane culture on the islands, the difference in elevation between the mill and the Government road, a distance of one and a half miles, being 1,000 feet.

As all of the cane has to be transported on mule wagons from the fields to the railroad, the heavy rains of last year very seriously interfered with the progress of the work, the running of the mill depending on the condition of the roads and the length of the haul, sometimes running a short day, and at times 12 or 14 hours.

For the coming crop, weather permitting, the output should approach 7,000 tons.

CONDENSED MONTHLY MILL REPORT OF THE PAAUHAU PLANTATION COMPANY, LIMITED, FOR 1890.

Month of	Days of Grinding.	Bags of Sugar.	Tonnage.	Days Lost.	Rainfall, Inches, Elev. 300ft.	Elev. 700ft.
January	24	7,573	473·625	2	10·13	16·15
February	23	7,483	467·1375	1	11·73	13·71
March	19	6,215	388·875	7	12·25	16·52
April	19	6,620	413·1500	7	4·63	5·49
May	17½	6,332	395·1500	9½	5·20	6·75
June	18	5,975	373·875	7	11·75	12·64
July	17½	5,676	354·1500	8½	20·60	21·99
August	24½	7,300	456·500	1½	13·32	13·96
September	26	8,956	559·1500	..	2·31	3·93
October	27	10,827	676·1375	..	9·27	9·65
November	23	10,379	648·1375	2	12·29	14·39
December	21	8,924	557·1500	5	14·06	18·17
	259½	92,260	5,766·500	50½	127·54	153·35

Letter to the *Planters' Monthly*.

RESULTS OF WORKING AT SOUTHDOWN FACTORY, LOUISIANA, 1890-91.

(From the *Louisiana Planter*).

Mr. A. Seeliger, chemist in control at Mr. H. C. Minor's well-known Southdown plantation during the season just ended, has favoured us with some of the leading data of the campaign:—

Acres of cane ground	945
Total yield in tons	21,974
Average yield per acre	$23\frac{25}{100}$

The mills were running $73\frac{3}{4}$ days, from October 9, 1890, to January 11, 1891, and the average mill work per 24 hours was $297\frac{95}{100}$ tons of cane.

There were obtained:—

4,292,772 gallons of juice.
844,047 gallons of syrup.
2,613,754 pounds of first sugar.
890,531 pounds of second sugar.

3,504,285 pounds, total first and second sugar.

Average yield of sugar per acre, 3,707 pounds.

The average yields per ton of cane were:—

195 gallons of juice.
38·4 gallons of syrup.
118·94 pounds of first sugar.
40·52 pounds of second sugar.
159·46 pounds total sugar, or $7\frac{97}{100}$ per cent.

There was consumed per ton of cane ground:—

109 pounds of coal.
140 pounds of wood.
2·13 pounds of lime.
0·20 pound of sulphur.

There was consumed per 1,000 pounds of sugar made:—

12,540 pounds of cane.
681 pounds of coal.
878 pounds of wood.
13·4 pounds of lime.
1·2 pounds of sulphur.

These figures show a most successful campaign at Southdown, and the immense crop handled reflects great credit on Southdown's worthy proprietor, Colonel H. C. Minor, and also Mr. A. Seeliger, chemist in control, in the sugar house. Although during the seventy-four

running days of the mill about 22,000 tons of cane were ground, or nearly 300 tons per day, ninety-four days of calender time were consumed, and the results reached show that had the mill run all the time, it would have had the capacity to grind 28,000 tons of cane.

The yield of juice per ton of cane, stated at 195 gallons, *probably includes some water of saturation*, as at $8\frac{3}{4}$ lbs. per gallon, that quantity would show over 1,700 lbs. per ton juice extraction, or 85%, and beating diffusion, if it were normal juice. The yield of sugar, just under 160 lbs. of sugar per ton of cane, shows good mill work, and was not surpassed by many mill houses in Louisiana this season.

A pound of coal should make a pound of sugar, and Mr. Minor seems to have about reached that standard of excellence, though a portion of his fuel having been wood confuses the data somewhat.

THE HUGHES DIFFUSION BATTERY.

The object of the present article is to describe the process invented by Mr. H. A. Hughes for the extraction of sugar from sugar cane, sorghum, and other similar plants.

What is called the "Diffusion Method" was first applied to the extraction of juice from beets about the year 1860, and has progressed from that time with various modifications until what is known as the "German Diffusion Battery" was developed, as used in Louisiana and other sugar-producing countries. The main objection to this form being the excessive dilution of juice, which is an inherent difficulty owing to the large percentage of waste space necessary, and also the great complication of cocks, valves, and connections which require to be judiciously handled to insure continuous working.

The difficulties encountered in working sorghum cane at Rio Grande in the years 1880 to 1884 led to the invention of the form of battery proposed to be described, as it was found impossible to crush the unstripped cane and obtain more than 53% on single milling, and even then the extractive matter of the leaves affected the quality of the sugar produced to a very objectionable extent. Supplemental milling considerably increased the yield of juice, but at a considerable expense both from additional power required and from dilution.

The fifth annual report of the New Jersey Agricultural Experimental Station (1884) gives the detailed account of the use of a diffusion battery of the German type at Rio Grande, the result being that it

was impossible to maintain satisfactory results from unstripped cane, and it was found by experiment that it would cost $9 per ton to remove the leaves and sheaths by hand.

A method of stripping the cane and removing the seed-tops automatically was devised and put in operation in 1886, consisting of means for cutting the cane into short pieces and blowing out the loosened leaves and sheaths, the cane being shredded by a rapidly-revolving knife into needle-like particles.

With the cane reduced to this condition the German battery gave good extraction, but with the usual great waste from excessive dilution. At the end of this season (1886) the Rio Grande Sugar Company concluded to abandon the attempt to put the business on a paying basis and retired from the contest.

In 1887 the Hughes Sugar-house Company was incorporated with the object in view of developing the methods of working sorghum cane devised by Mr. Hughes, and to evolve from work actually done the plans for a model sugar-house that would reduce the cost of construction and operation to a minimum.

A sugar-house was built at Rio Grande of a capacity of 15 tons of field cane per day, with cleaning and shredding apparatus which worked very satisfactorily.

A novel form of diffusion battery was constructed, based on the laboratory experiments of the previous years, consisting of ten circular vessels surrounding a ten-armed hydraulic crane, upon which were hung 10 baskets of perforated metal, which fitted closely in the vessels.

By raising and lowering the crane these baskets can be dipped consecutively in the vessels, and from a careful study of the results it was decided that it was best to give each basket 19 dips before replacing with a fresh charge of chips. Another cell was added outside of the circle, into which the juice was discharged from the battery and the fresh basket of chips dipped first, before being placed on the revolving crane.

The function of this 11th cell is most important, as, owing to the absorption, it enables juice of practically equal density to that contained in the cane to be obtained, or in other words, that there is no dilution in this battery as compared with the results stated in published reports of the German batteries in use in Kansas and Louisiana of from 30 to 40%.

This small battery has the unparalleled record credited to it for the

first season, of an *extraction of 90%*, and one hundred and fifteen pounds of sugar actually sold from each ton of field cane with seed tops on, or 1,899 lbs. of sugar to the acre, and one hundred and eleven $56-100 in cash from each acre of cane worked.

In 1889 a new battery was put in, of a capacity of 70 tons per day, and embodying some improvements in method of heating, charging and emptying the cells and handling the baskets, and the results were so satisfactory that we are able to state from the report of the U. S. Chemist that the juice obtained was of equal density with that obtained from stripped cane passed *through a single mill.*

In regard to inversion there is very little difference between the records of the German Battery at "Magnolia," La., on the tropical cane and that at Rio Grande on sorghum, the former being 1·80 and the latter 1·3 to 2·00. The records of Fort Scott cannot be compared on account of the carbonate of lime records.

It has been claimed that the contact of air in the open cells and baskets of the Hughes Battery would cause inversion, but it has been observed that as vapour is constantly passing from the exposed surfaces, there can be no contact of air.

The most marked difference in the systems is in the dilution of juice, that of Magnolia averaging 57%, Fort Scott 45·9, while Rio Grande was only 10·7, in 1888. In 1889, the density was equal to mill juice.

The following comparison might be made between the German and Hughes Batteries:—

German.	Hughes.
1. Great cost.	1. Low first cost.
2. Heavy foundations.	2. Foundations light and simple.
3. Elevated water tanks to supply pressure for circulation and joints.	3. Tanks only slightly elevated.
4. Complicated and costly water and juice pipes, cocks, &c.	4. No complications of pipes, as *one cock* serves to charge and empty each cell.
5. Costly and troublesome heaters to each cell.	5. No heaters, a simple coil in bottom of cell answers, as it is in continuous operation.
6. The form of cells prevents the chips from being properly packed, resulting in waste spaces, which allow of dilution.	6. 38 lbs. can be packed to the cubic foot, as against 27 in other batteries.

German.	Hughes.
7. If the calorizators do not heat the juice very hot, the extraction is poor; if the juice boils, the circulation stops.	7. The cells can be maintained at a boiling temperature.
8. Circulation may be prevented by reason of one of the numerous valves being imperfectly closed or defective, and it is difficult to locate the trouble quickly.	8. The juice is stationary, and therefore there is no circulation to be impeded.
9. The liability to ferment, owing to dirty pipes.	9. All parts being open and accessible, can be readily cleaned.
10. The loss of sugar in waste water.	10. There is no waste water.
11. The great dilution of juice.	11. The juice is not diluted.
12. The large amount of water necessary for "washing down."	12. The amount of water required is only about equal to weight of chips.
13. Contamination of streams and air by fermenting waste waters.	13. None.
	14. Can be worked fast and slow, and capacity doubled when necessary, to work at the expense of some loss of sugar.
	15. Can be examined in all parts at a glance, and any trouble corrected at once.

The wear and tear of the 70-ton battery last season did not cost one cent., and it was left in perfect working order.

The low cost of construction of this battery warrants its use in places where the season is short, and by reason of its economy in use of water it can be made available in localities where the other forms could not be.

The best and cheapest method of making sugar is by means of a central house and auxiliaries, and for the purpose of illustration we will suppose one equipped with 10 branches, each having a capacity of working up 100 tons of field cane in 24 hours.

It has been found that it is quite easy to obtain a supply of 100 tons of sorghum cane in 10 hours for say a season of 70 days, quite difficult to get in 150 tons, and almost impossible to get in 200 tons for that time.

There are many reasons for this which it is not necessary to enter into here, but the records show it to be a fact.

Seventy thousand tons of field cane would be worked in 70 days, and with the following expenditure for each of the auxiliaries:—

10 hands in day and 7 at night, at $1·50	$25·50
3 carts, at $2·00	6·00
Lights and oil	2·00
3 tons of coal, at $3·00	9·00
100 tons of cane, at $1·50	150·00
	$192·50

Allowing only 20 gallons of syrup to be obtained from each ton of cane, the cost per gallon would be 192·50÷(20×100)=·09675 cents.

The present cost of importing Cuba molasses is 16 cents per gallon, which includes cooperage, breakage, freight, duty, insurance, and all charges, *but not the original cost in Cuba.*

The average of all canes delivered during the months of September, October, and November, to the sugar-house at Attica, Kansas, tested—

Brix.	Sugar.	Purity.
17·2	11·57	67·5

The records of Rio Grande show the following figures per ton of 2,000 lbs.:—

Seed, leaves and sheathes, 26%	520
Clean chips	1,480
Fibre, 12%	178
Juice in cane	1,302
Extraction, 90%	
Juice in tanks of 17 Brix.	1,171

Which would be equal to 24 gallons of syrup of 49%, pure cane sugar, which if worked in the same manner as Cuba molasses would yield 108 lbs. of sugar per ton of cane.

The cost of running a central house capable of handling the syrup from 10 auxiliaries would be:—

Labour of all kinds, per day, $70·00....	$7,000 00	
500 tons of coal, at $3·00	1,500 00	
5,000 molasses hhds.	5,000 00	
4,000 sugar hhds.	4,000 00	
Labour at 10 auxiliaries	134,750 00	
Freight, from auxiliaries to central house, 1 cent on 1,400,000 gals. syrup	14,000 00	
Wear and tear, insurance, taxes and expenses between seasons	20,000 00	
		$186,250 00

Taking the low estimate of 4lbs. per gallon of syrup worked, the yield would be of sugar......	5,600,000 lbs.
Remaining syrup	800,000 gals.
Seed	100,000 bush.

The valuation of which would be :—

5,600,000 lbs. at 5 cents	$280,000 00
800,000 gals. at 8 cents	64,000 00
100,000 bush. seed at 10 cents	10,000 00
	$354,000 00
Cost of production	186,250 00
Profit............	$157,750 00

In New Jersey, the value of sorghum seed equals the price of corn.

In order to work the central sugar-house to the best advantage, it should be run for at least seven months of the year, which would require the syrup from 30 auxiliaries as above described, with a corresponding increase in the value of the output to over *one million dollars, and showing a profit of nearly one hundred per cent.*

The cost of plant to attain the above results may safely be estimated as follows :—

30 auxiliaries, at $20,000	$600,000 00
Central house	120,000 00
	$720,000 00

The above statements and figures are not based on theory, but are the results of careful consideration of well-known facts, and care has been taken to keep well within the known possibilities.

When it is remembered that the consumption of sugar in the United States is at least 50 lbs. per capita per year, making a total of over 3,000,000,000 pounds, and that the area in which sorghum can be grown to advantage extends over numerous States, some idea of the importance of the industry may be obtained.

Henry G. Morris.

Philadelphia, 1890.

UNITED STATES.

Profits on Sugar Refining.

Some of our hard pressed refiners will read with an involuntary feeling of envy the following remarks from the New York *Market Journal*:—

"We have always maintained that there was money in refining sugar. We have asserted this time and time again for the last ten years. The reasons were to our mind quite obvious, and at the same time most conclusive. In the first place, in all our experience, extending over twenty-five years' connection with the trade, we have never known a poor sugar refiner. We do not confine our remarks to this country, but the same thing applies to the United Kingdom and to France and to most parts of Germany. In all countries those people engaged in refining sugar have a chronic complaint that profits are small. They may be small in percentage of the volume of business transacted, but they are unquestionably large in the aggregate. Most of the richest refiners of sugar in the world have started almost with a single kettle over their kitchen fire as it were, and none of them have been assisted by patent rights that could give them any great advantage. Our opinion has been more than once questioned, but we think that proof has recently been given which vindicates the position we have taken, in the most complete manner, by the evidence that has been given before the Sugar Trust inquiry by the Senate Committee from Albany. One man, a sugar refiner, admits that he received from the Trust $5,631,000 worth of certificates for a business that could not possibly be capitalized for more than $1,600,000. He admitted that the firm had made as high as 200 per cent. profit in a year, and we know this to have been the case. That the American Sugar Refining Company is capitalized at $50,000,000, and capable of paying a 10 per cent. dividend, besides large salaries and accumulating a very large reserve fund, is proof positive that there is lots of money in refining sugar. It is generally admitted that the present American Sugar Refining Company is not run very economically, from the fact that it has had to purchase and acquire useless property, and it is compelled to pay dividends upon an exorbitant capital, at least four times as much as what it is necessary to carry. Some of its property and machinery were practically valueless for sugar refining purposes, and nothing could to-day save it if proper competition, under good

management, came to the fore. In the first place, it would prevent the present method of squeezing the market and a consumer at the same time, and it would produce a more healthful condition in the raw sugar market. If a company was organized with a capital of say $3,000,000, and managed as it ought to be, in a year from now the property of the Sugar Trust would be worth about one-half what it is to-day, and that price would be more than its real value. To-day there is not a better opportunity for the investment of capital, under proper conditions and management, than in a new corporation for refining sugar in competition with the Trust."

Apropos of these statements, the New York *Merchants' Review*, from which we extract the above paragraph, observes:—"If the sugar refining business has been so profitable under a protective duty of $\frac{3}{4}$ @ $1\frac{1}{4}$ cents as to allow of a return to refiners of 200 per cent., surely there is no reason why they should not make a mighty good living with the protection of $\frac{1}{2}$ cent afforded by the new tariff."

The flourishing state of the United States refiners offers a strong contrast to that of our Clyde refineries, as depicted in the *Greenock Telegraph* in its summary of results for 1890.

The writer, after referring to the discouragement of cane sugar cultivation resulting from the heavy bounties still given by certain European nations on beet-root sugar, and the inevitable effect of this state of things, goes on to remark:—

"The Greenock refiners have got into a state of almost absolute dependence upon the beetroot crop. Cane sugar growers no longer find it worth their while to send their produce to their markets, and thus when the stocks of beet sugar get exhausted our sugarhouses have to stop, and our workmen go idle.

"The increasing quantity of bounty-fed foreign refined sugar imported into this country continues to be the black feature in the outlook of the Greenock trade; and the stern reality of its effects is only too visible in the East-end of our town, where large blocks of premises, once busy with the work of sugar refining and admirably adapted for such industry, are either silent altogether or resonant only with the crash of the hammer of the breaker-up. Last year the Ingleston Sugarhouse was broken up; it is being followed this year by the Baker Street house of Messrs. Alexander Scott & Sons, a refinery wherein the late senior of that firm, along with his partners Mr. James Duncan and Mr. James Bell, established their reputation

as among the most skilful and successful men in the trade, and inaugurated many of those improvements in the manufacture which have secured for Greenock sugars their well-preserved pre-eminence. It is sad to think of such a house as this being converted into bricks and old iron. With its splendid water supply and its proximity to the harbours and railway stations, it ought still to have been working, had natural advantages, the commercial and technical knowledge of masters, and the industrial skill of workmen alone been concerned. But as the fair-player must ultimately succumb when the dice are loaded, so must the unaided British manufacturer ultimately be worsted in a competition with foreign rivals who have the resources of the taxpayers of their nations to bolster them up.

"Some attention has been given to the probable effect of the M'Kinley tariff in America on the sugar trade of Greenock, and those best able to form an opinion think that it will make little difference to us; it may to a small extent be in our favour, as it may permit an export of the lower grades of yellow sugar from Greenock to New York, and, by the discouragement of molasses refining in America, may direct the West Indian molasses to this side of the water, and possibly encourage the resumption of the working of molasses here, a branch of the industry which used to be extensively prosecuted in Greenock, but which has for many years been extinct.

"The proposed changes in sugar legislation on the Continent have been watched with some interest by our refiners, although it must be confessed that that interest is becoming of the most languid sort, as the hope of arriving at an abolition of bounties seems fated to suffer constant disappointments. The changes proposed by the foreign Governments are always to take effect at some date so far future that in the interval there is always time and opportunity for those whose gains are to be affected to raise endless objections ard worry the Governments into concessions which completely frustrate the good intentions of their *projets de loi*.

"On a review of the whole situation we are compelled to come to the conclusion that the prospects of foreign competition tend in the direction of its increasing rather than diminishing. A larger proportion, year by year, of the European crop is being made in a form ready for use without refining, and unless our refiners get a cheaper raw material they will not be able to compete. They might have go t the raw beetroot sugar at a price more commensurate with that of

foreign refined had they not lent themselves to the speculative system of the Beetroot Sugar Associations, whose whole regulations appear to be based upon the intention of making it easy for jobbers to work the article in gambling fashion. The legitimate buyer who wants sugar for using, when he goes into the market to buy, finds competing with him a dozen speculators, and the sugar he gets has often passed through many hands. In order to make a living off the sugar, each of these speculators must get some profit out of it, and these accumulated percentages must ultimately be borne by the man who at last takes the sugar off the market and puts it in the melting pot. Thus the raw material mounts in price, and the refiner can no longer make a fair manufacturing profit from his industry."

UNITED STATES.

Report of Working of the Caffery Central Refinery, Franklin (Louisiana).

We have received the report of the above Central Refinery, which commenced work on the 29th October, 1890. From this we extract the following details, being those which are calculated to be of general interest to our readers. The building is of the most approved construction, solidly built, and the plant of the newest type. In connection with the refinery are over 12 miles of rails. There are several points in this report to which we invite attention, particularly in regard to the working of the seven roller mill with saturation.

Machinery.

Mill.—The mill is a 7-roller mill, constructed by Leeds & Co., of New Orleans. This mill consists of one 3-roller mill and two 2-roller mills. The 3-roller mill is 32in. diameter, 6ft. long. The middle 2-roller mill is 48in. diameter, 6ft. 3in. long. The back or last 2-roller mill is 60in. diameter, 6ft. 6in. long. The cane carrier is 5ft. 9in. wide, 180ft. long. The two intermediate carriers are constructed of iron slats, ¼in. by 2in., working over rollers and driven by cog-gear and pitched chain from mills. Perforated brass pipes are placed just above each of the two intermediate carriers for saturating the bagasse on the carriers. The mills are triple geared with very powerful and heavy gearing driven by a slide-valve engine, 30in. diameter, 48in. stroke.

The 3-roller mill is provided with hydraulic ram having a capacity of 225 tons. The first 2-roller mill is provided with hydraulic ram having a capacity of 450 tons. The second or last 2-roller mill is provided with hydraulic ram having a capacity of 900 tons. The juice pans from the mills are connected, and the juice flows through one common trough on a perforated screen, where the trash is swept off, and the juice falls into the sulphur box placed beneath the mill. This sulphur box consists of a wooden enclosure having shelves of perforated copper; the juice falls through these perforations into a pit at the bottom, the sulphur being generated, cooled, washed and drawn from the bottom of the sulphur box. The sulphured juice from the pit underneath the sulphur box is pumped into the measuring tanks in the peak of the house, where the quantity is accurately measured. From the measuring tanks the juice runs into a set of ten copper clarifiers placed on one side of the building on the fourth floor. These clarifiers are 6ft. wide, 8ft. long, and 4ft. deep, provided with the usual wash-outs, connected to skimming tanks, &c. Each clarifier is provided with three draw-offs, one 18 inches from top, one 18 inches from the bottom and one at the bottom. All the skimmings from the clarifiers are lead to the scum tanks placed on the ground floor of the building. The clarified juice from the clarifiers falls by gravity into the sweeps or brushes placed on the third floor.

From the brushes the juice falls by gravity to the charging tanks placed on the second floor; the valves and conducts being so arranged as to discharge into these charging tanks from clarifiers or from sweeps, as may be desired. From the charging tanks the juice is drawn into the triple effect, where it is evaporated into syrup and passes into pumps placed on the ground floor, which throws the syrup into larger syrup tanks placed on the third floor, or to the syrup filter press tank placed on the third floor.

The syrup tanks on the third floor are 6ft. wide, 6ft. 6in. high, 14ft. long, provided with three draw-offs and with a glass tube to show level of the syrup. Behind these glass tubes and on the tanks is placed a scale so graduated that by merely noting the height of syrup in the tank by the glass tubes the contents are known.

On the second floor, directly under the syrup tanks, are placed two large charging tanks, one for each pan, and each tank having the capacity of one strike.

On the fourth floor is placed the tankage for seconds and thirds. These tanks are of the same dimensions and construction as the syrup tanks, except that they are not provided with three draw-offs and glass tubes.

Vacuum Pans.

There are two vacuum pans, one 10ft. and one 8ft., constructed by the Caldwell Iron Works, and erected by Mr. J. H. Murphy, of New Orleans. Both of these pans are fitted up and provided with high and low pressure manifold. The 10ft. pan has seven double 4in. copper coils. The 8ft. pan has six double 4in. copper coils. The pans are put up and arranged in such manner that all the first product is boiled in the 10ft. pan, the second and third in the 8ft. pan. All the connections are so arranged that they may be used vice versa in the event of an accident to either pan. The charging pipes from the 8ft. pan and the 10ft. pan are so arranged with valves that either pan can draw syrup from the large charging tanks, from the syrup tanks, or from the second and third tankage; also that one pan can draw into the other, should an accident occur rendering it necessary.

The discharge of the 10ft. pan is arranged to discharge either into the first mixer or into the hot room. The discharge of the 8ft. pan is so arranged as to discharge into either first mixer, into hot room, or into third tankage. The molasses discharge from both the 8ft. and 10ft. pans discharges on to molasses cooler placed on the second floor of the refinery. From this cooler the molasses runs through a pipe placed on the outside of the building and extending the whole length of the hot room, where it discharges into two large molasses tanks placed at the further end of the packing room directly under the hot room. These tanks are set at sufficient elevation to allow the barrels to be filled directly over a well, which has an elevation level with the floor of a railroad car standing on the track, so that as the molasses is run into barrels any dropping or waste is caught in the cemented well, and the barrels are rolled off into cars.

The second product, which is boiled in either the 8ft. or 10ft. pan, is discharged by a large iron chute, having a capacity to hold one strike. This chute extends from the vacuum pans into the hot room, and the product is discharged in cars directly in the hot room, by which arrangement we are enabled to discharge quickly and without danger of burning the masse cuite; as also delivering into the hot rooms without allowing the cars to come out.

The third product is boiled in the 8ft. pan and discharged through 6in. pipes into large tanks placed in supplementary hot room on ground floor directly under hot room for seconds. When this product has drained it will be macerated and pumped into the centrifugal mixers.

The hot room is heated from overhead by four manifold steam pipes extending the whole length of hot room; each manifold consists of six 1½in. pipes.

When the second product is sufficiently grained it is dumped into a centrifugal mixer placed in hot room and is dried by a four machine, Hepworth Improved Centrifugal setting, placed in the packing room directly under the hot room. The sugar as dried being delivered by elevator into sugar bin placed on second floor of Refinery building, where it is delivered into Eureka packers and packed into barrels. The first sugars are dried by a six machine, Hepworth Improved Centrifugal setting, placed on the ground floor of Refinery building, and delivered to elevator, so arranged as to deliver sugar either into granulator or directly into barrel packer as may be desired. These first sugars are all packed into barrels by the Hersey Barrel Packers.

Both the first and second sugars are delivered from centrifugals on to endless belt running directly under same, and delivered to the elevators above referred to.

The molasses from both first and second centrifugal passes through a Vilavasso Mixer, and is pumped up to second and third tankage on fourth floor of Refinery building.

Working of the Mill.

The actual running time of the mill was 1534 hours, or 63 days, 22 hours, and the average milling of cane, 21·04 tons per hour, or 504·96 tons per day. Saturation between the mills was practised throughout the whole season. Tests to compare results of different saturation were made as per the following table:—

Feed per 24 Hours. Tons.	Fibre Per Cent. of Cane.	Saturation.	Per Cent. Dilution of Juice.	Extraction.
417	11·90	None	None	70·18
515	10·80	After first mill	8·55	71·94
480	11·18	After second mill..........	6·00	74·83
500	10·34	After first and second mill..	12·70	79·50

The average dilution of the juice during the whole season amounted to 8·74 per cent., and the average extraction was 75·14 per cent. There is no doubt but that the whole secret of a good extraction depends upon the condition of the cane; if plant or stubble, and in a regular feed proportioned to the size of the mill; in grinding stubble cane, with 12 per cent. fibre, and an irregular feed the extraction at this place went sometimes below 70 per cent., when on the contrary, in grinding soft plant cane with 10 per cent. fibre and a regular feed, the extraction came often up to 80 per cent. As to the merits and demerits of a back mill of large diameter, it has been demonstrated here that equal, if not better results, could have been obtained with a back mill of much smaller diameter than 60 inches.

Mr. Golding, of New Orleans, once mentioned in a meeting of the Sugar Planters' Association that in having a mill of two large a diameter, the juice would follow the bagasse and be re-absorbed. He is correct in this. It was observed that the contact between the two rollers is undoubtedly too great; a large portion of the juice cannot run back, but follows and is absorbed by the fine dry bagasse like a sponge.

The only merit of a mill of a large diameter will consist in making very fine bagasse, in fact, so fine that even the small holes of centrifugal cloth are large enough to let it pass, which is also a detriment, as this fine bagasse increases the bulk of the skums and fouls up the juice and products, thereby deteriorating their value.

Treatment of the Raw Juice.

The juice coming from the mill was treated in the usual way with sulphur dioxide fumes; special care was taken to construct such a sulphur machine which would accomplish a perfect saturation of the juice with the fumes without any inversion and with as much economy of sulphur as possible. The daily consumption of sulphur amounted to but 40lbs., and the juice was completely saturated without being inverted, as the following table will show:—

Raw Juice.

	Per cent.
Solids (Brix)	16·21
Sucrose	13·50
Glucose	1·57
Glucose ratio	11·6
Coefficient of purity	83·2

Sulphured Juice.	Per cent.
Solids (Brix)	15·08
Sucrose	12·37
Glucose	1·44
Glucose ratio	11·6
Coefficient of purity	82·0

In preparing the sulphur fumes care must be taken to avoid the forming of sulphuric acid, or when this should happen, the latter must be trapped before it comes in contact with the juice. There is no danger of inverting sugar in a cold solution. The reasonable use of sulphur fumes is of great assistance to the clarification, and as a preserving agent moderate sulphuring is to be recommended.

Clarification.

The juice, before going to the clarifiers, was carefully measured in two special tanks; there were 4506 clarifiers of juice made, each clarifier containing 1205 gallons. The lime was added in powder form on an average of 10·9 lbs. per clarifier, or 0·10 per cent. of the juice. The clarification itself was strictly neutral and showed an improvement in the purity of the juice.

Analysis of Clarified Juice.	Per cent.
Solids (Brix)	15·06
Sucrose	12·86
Glucose	1·40
Glucose ratio	10·8
Coefficient of purity	85·3

Syrup.

After sufficient settling the clarified juice was immediately sent to the Swenson Triple Effect, and there concentrated to a density of 26 degrees, Baumé. The Swenson apparatus worked very satisfactorily. The syrup was measured in gauged tanks and was taken directly to the vacuum pans as soon as a sufficient quantity of it was collected to make a strike. The main object in working this factory was to handle the juices as quickly as possible, in order to avoid inversion, and even then the latter took place to a certain extent.

Analysis of Syrup.	Per cent.
Solids (Brix)	46·78
Sucrose	39·00
Glucose	4·62
Glucose ratio	11·84
Purity	83·3

Filtering of Syrup.

A trial run was made with two sand presses, Bauer patent, built in Germany by the Saugerhausen Iron Works. The filtered syrup was free from mechanical impurities.

Analysis.

	Not Filtered. Per cent.	Filtered. Per cent.
Solids	51·48	50·48
Sucrose	42·10	41·30
Glucose	5·22	5·13
Glucose ratio	12·39	12·42
Purity	81·77	81·81

The masse cuite of the filtered syrup boiled more freely and produced sugar 0·2 per cent. higher polarization and a better colour than the sugar of the unfiltered syrup. It was also observed that the filtered syrup kept 39 hours longer than the unfiltered without fermenting. This shows that the mechanical (vegetable) impurities act as an important factor on the inversion and fermentation of juices. So far, the filtering of syrup would be recommended, but the sand presses are objectionable for the following reasons:—

1. Unless a steady and even pressure is maintained, the presses choke up at once.

2. After the presses are run under a steady and even pressure for three hours, the flow slackens off and it is necessary to wash the sand, which operation consumes about seventy-five minutes and requires a large quantity of water which has to be evaporated.

3. It is not economical to wash the sand entirely free from sugar; and there is consequently a loss entailed every time the presses are opened.

4. The proper manipulation of the presses requires the services of skilled men.

First Masse Cuite.

The 10ft. vacuum, to boil the first product, was provided with high and low steam pressure. Exhaust steam was used on triple effect and 8ft. pan; the first vacuum pan was boiled with live steam, reduced to 35lbs. The average time to boil a strike of 30,000lbs. dry sugar was four hours. The masse cuite was dropped into a gauge mixer, and there note taken of the exact quantity, and sampled for the chemical control.

Analysis of First Masse Cuite.	Per cent.
Solids	92·98
Sucrose	77·00
Glucose	9·73
Glucose ratio	12·63
Purity	82·8

(*To be continued.*)

BARBADOS.

Experiments at Dodds Reformatory.

The second part of *Timehri* for 1890 contains, among other very interesting matters chiefly relating to British Guiana, a paper by Professor Harrison, M.A., F.G.S., F.C.S., &c., the Government Analytical Chemist, on the work which was done by himself and Mr. Bovell from 1884 to 1889 at Dodds Reformatory, Barbados. Our readers will remember that we have from time to time given copious notices of the experiments and their results, but the summary of the conclusions with regard to manures at which Professor Harrison arrived seems well worth repeating, and we therefore extract this portion. One feature with regard to this work has hitherto escaped our notice, and we think deserves remark, as indicating a further and very notable item in the debt of gratitude which all must acknowledge to be owing to these gentlemen. Professor Harrison—after stating that about the end of 1884 he consulted with Mr. Bovell as to the feasibility of making manurial experiments as well as those relating to suitable varieties of cane, and they applied for permission to the Executive to do so—remarks :—" Permission was granted, but with the proviso that no expenditure beyond that necessary for the cultivation of the land in the ordinary way was to be incurred, and *until 1889 any expenses incurred for necessary apparatus, &c., were paid by Mr. Bovell and myself.*"—[The italics are ours.]

The following is Professor Harrison's summary :—

"The following conclusions may be fairly drawn from the experiments with manures :—

"1. The addition of readily available nitrogen to mineral manures produces large increases in the weights of canes grown and sugar obtained, but dressings of over 250 lbs. per acre of sulphate of ammonia do not produce corresponding increases under ordinary climatic conditions, and may cause a marked decrease in the richness and purity of the juice.

"2. The most favourable form in which nitrogen can be employed for manuring the sugar cane, appears to be sulphate of ammonia, no advantage appearing to be gained by the use of mixtures of organic and ammoniacal nitrogen in its place.

"3. Under climatic and soil conditions which have proved to be

very favourable for the production of increased yields of sugar cane by the use of nitrogenous manures, nitrate of soda proved much inferior to sulphate of ammonia as a source of nitrogen.

"4. The presence of phosphate in the manures is essential for the maximum return of sugar cane for manuring.

"5. Phosphates appear to be preferable in the form of superphosphate of lime, but very great care must be exercised in its application, as whilst dressings capable of supplying from 75 to 80 lbs. per acre of 'soluble phosphates' produced excellent results, dressings supplying larger quantities did not produce corresponding increases, and excessive dressings may, upon soils at all deficient in active lime, yield returns but slightly greater or even less than those obtained without them.

"6. On soils, such as those at Dodds, deficient in organic matters, the use of insoluble phosphates does not appear advisable.

"7. In soils at all deficient in potash, the addition of potash, in the form of sulphate of potash, to the manures gives largely increased yields, and the use of potash in large quantities does not injuriously affect the purity of the juice. It is well known that during recent years the crops of Barbados very greatly increased, and that this increase was due mainly to increased yield of canes in the field, and not to improvements in the manufacture of sugar, to which latter the majority of Barbados planters have certain rooted objections. Now, as for many years practically all the manures used in Barbados passed through my hands for analysis, having been sent either directly by the makers or by the Agricultural Society, I am in a position to state that the increased crops coincided with changes in the compositions of the manures used. Ten years ago the manures contained less nitrogen than do those used at present, a considerable proportion of the nitrogen being in the form of organic matters, high proportions of 'soluble phosphates' and but little or no potash; whilst the manures used now contain their nitrogen almost entirely as sulphate of ammonia, 'soluble phosphates' in much lessened proportions, and considerable quantities of potash; these changes being consistent with the deductions drawn from the Dodds experiments and thus strongly confirming them. At the same time I must mention that since 1884 large and increasing quantities of manures, known as early cane manures and containing from 4 to 5% of nitrogen, from 16 to 20% of 'soluble phosphates,' and from 6 to 10% of potash, are

applied to the canes soon after they spring or even to the soil shortly before the canes are planted. The use of these manures, suggested originally by Mr. George Hughes in his report to the Barbados Agricultural Society for 1880, but the composition of which, as now used, I first pointed out to the Anglo-Continental Manure Company in 1883 and 1884, has, in the general opinion of the planters, proved successful, and a high value is ascribed to them.

"Are these deductions applicable to the soils and climatic conditions of this colony (British Guiana)? From what I have seen since my arrival here, and from many soil analyses which I have since made, I am inclined to believe that the first and second are probably applicable; that the third requires experimental enquiry, as upon our heavy clay soils, reasoning from analogy with European experiments, nitrate of soda, if applied with due caution, should give fully equivalent results to sulphate of ammonia; that the fourth is fully applicable; that careful experiments require to be made with regard to the fifth and sixth; and that owing to the large quantities of potash present in many of our soils, the application of potash salts may be without beneficial action, whilst upon others and especially upon soils long under cultivation its use may be beneficial.

"By the system adopted here of leaving the fallen and stripped leaves and the tops of the canes upon the land, about 64% of the potash taken up by the crop is at once restored to the soil.

"What is urgently required in this colony is an agricultural experiment station, where experiments would be carried on under strict scientific control, both botanical and chemical, and upon the lines and with the methods pointed out by modern agricultural research."

The summary of results obtained from the experiments on varieties of canes is also valuable; we therefore reproduce it, and it may be usefully compared with summaries of experiments in other countries which will be found in the *Sugar Cane* for March, 1891 (pp. 150 to 152), February, 1891 (p. 87), September, 1890 (p. 483), and January, 1890 (p. 45).

"Experiments with varieties of Canes.

"Experiments with certain varieties of canes received from Jamaica and selected by Mr. Morris as specially suited to Barbados, and with varieties previously cultivated there, were systematically made at Dodds, and by Mr. Armstrong at Little Island, where the

rainfall and soil conditions differ greatly from those at Dodds and have a greater resemblance to those occurring here, with a limited number of varieties. The average results of the experiments at Dodds are given in the following table, the names used for the varieties being those adopted by Mr. Jenman. In the table, under the name of Bourbon are included the results obtained with the Bourbon and Lahaina canes, under that of Red Ribbon cane, those with the Red Ribbon and Striped Singapore, under that of White Transparent those with White Transparent, Rappoe and Caledonian Queen, under that of Purple Transparent those with the Meera, Purple Transparent and Queensland Creole, and under Salangore those with the Salangore and White Mauritius, these names being merely synonyms and not names of true varieties:—

Names of Canes.	Weight of Canes.		Extraction of juice per cent.	Gallons of juice per acre.	Specific gravity.	Degree Beaumé.	Lbs. per gallons of		Purity.	Lbs. of Sucrose in juice per acre.	Lbs. less of Sucrose yielded by variety than by the Bourbon, per acre.
	tns.	cwt					Sucrose.	Glucose.			
Bourbon	36	10·6	63·8	4842	1081	10·7	1·807	·067	86	8749	..
White Tr'nspar'nt	30	19·3	58·5	3743	1088	11·6	2·055	·063	90	7691	1058
Red Ribbon	29	12·3	62·2	3806	1087	11·5	2·006	·056	88·6	7640	1109
Purple Tr'nspar'nt	31	1·7	57·8	3720	1084	11·2	1·996	·065	90·9	7425	1324
Keni Keni	31	1·9	62	3995	1083	11	1·837	·089	85·1	7338	1411
Po-a-ole	32	18·7	60·8	4153	1081	10·8	1·741	·113	82·8	7230	1519
Mani	28	1·4	60·3	3520	1077	10·3	1·677	·091	84·	5903	2846
Elephant	29	8·4	58·2	3567	1075	10·1	1·504	·100	77·1	5363	3386
Sacuri	21	11·2	60·9	2708	1068	11·6	1·980	·078	86·6	5362	3387
Salangore	24	3	60·7	3046	1078	10·5	1·683	·117	83·2	5126	3623
Bois-rouge	23	1·9	53·7	2563	1086	11·3	1·910	·076	85·2	4895	3854
Keening	21	17·5	56·9	2530	1084	11·2	1·923	·075	88·1	4865	3884
Meligeli	23	7·6	56·7	2752	1081	10·8	1·746	·123	83·1	4805	3944
Jam. Elephant ..	21	16·5	55·9	2537	1079	10·6	1·744	·096	85·1	4424	4325
Hillii	19	16·8	58·7	2418	1081	10·8	1·819	·071	86·6	4398	4351
Creole	17	2·3	54	1916	1082	10·9	1·795	·075	84·	3439	5310
Canne Morte	16	14·1	51·6	1788	1083	11	1·895	·082	87·8	3388	5361
Batramic	18	9·9	48·2	1849	1082	10·9	1·906	·079	89·2	3524	5225

"*The Barbados and Jamaica names.* Po-a-ole=Purple Mauritius. Mani=Norman. Boisrouge=Naga. Keening=Bouronappa. Meligeli=Demerara. Canne Morte=Mamuri.

"The results are interesting as showing that the Bourbon is by far the best cane at present known for cultivation at Dodds, that the White Transparent, the Red Ribbon, and the Purple Transparent Canes, which have been long cultivated in the West Indies, and which are the varieties chiefly cultivated in Louisiana, follow next, and that of the varieties selected by Mr. Morris, the Keni-Keni,

Po-a-ole and Mani alone possess characteristics in any way qualifying them for use as sugar producers, the remaining kinds appearing to have been selected with the object of showing how bad a cane can be. These experiments at Dodds have been made only with plant canes.

"At Little Island the following results were obtained with canes as plant canes and as 1st and 2nd ratoons, and are of interest as confirming the results obtained at Dodds, the Bourbon cane being conspicuously to the fore, and followed by the Keni-Keni, Po-a-ole and Mani in the same order of yield as there :—

Names of Canes.	Weight of Canes.		Extraction of juice per cent.	Gallons of juice per acre.	Specific gravity.	Degree Beaumé.	Lbs. per gallon of		Purity.	Lbs. of Sucrose in juice per acre.	Llbs. less of Sucrose yielded by the variety than by the Bourbon.
	tns.	cwt					Sucrose.	Glucose			
Bourbon	58	9·3	65·4	7945	1010	10·7	1·791	·059	86·2	14,230	..
Keni Keni	49	19·3	66·8	6900	1083	11	1·918	·043	88·8	13,234	996
Po-a-ole	54	12·2	74·9	8587	1069	9·4	1·449	·121	80·9	12,442	1,788
Mani	51	8·1	69·1	7408	1074	10	1·629	·076	84·5	12,067	2,163
Sacuri	37	18·4	61·9	4873	1079	10·6	1·796	·062	87·4	8,752	5,478
Salangore	35	13·3	74·6	5580	1068	9·3	1·465	·078	82·9	8,174	6,056
Jam. Elephant ..	30	12·5	69·7	4440	1077	10·3	1·725	·061	86·4	7,659	6,571
Canne Morte	17	19·8	66·6	2500	1073	9·9	1·653	·075	87·3	4,132	10,098

"From these two series of experiments it is evident that the Bourbon remains at present the best cane, a result strongly confirmed by the experiments carried on at the Botanic Gardens here, and we find that the majority of the canes giving results next to the Bourbon are those which have been long cultivated in the West Indies, and which, under different names, have also been obtained from other sugar producing countries. Experience, therefore, in widely different places, appears to have already selected the best canes from those known, and little chance of increased yield appears in the experimental cultivation of the known varieties. We find that certain varieties, both in Barbados and British Guiana, as a rule, yield juices richer in sucrose than the Bourbon does, and our hopes must be based upon obtaining from these varieties, by means of the seeds, canes uniting the saccharine richness of the parents with the robust habit of the Bourbon, or from the seeds of the latter, canes of greater saccharine strength."

DEFECATION BY ELECTROLYSIS.

The Maigrot and Sabatés Patent.

(Continued from page 155.)

The essential portion of the apparatus consists of a wooden trough, of pine or any other kind of wood, of the ordinary shape, having the following dimensions:—Length, 4 metres (13 feet); width, 20 centimetres (8 inches); and depth 35 centimetres (13¾). The length may be greater or less according to the size of the place where it is set up, the other dimensions remaining the same. This trough is divided into three compartments or troughs by means of a sheet of pergament paper *(no endosmótico)*, so that the principal trough forms three smaller troughs, the middle one being 10 centimetres (4 inches), and the two sides ones each 5 centimetres (2 inches) wide. In the centre of each of these troughs is fixed a plate or plaque of carbon running from one end to the other; this plate is composed of fifteen plaques, which, galvanised at one edge and cemented (soldered) to a sheet of copper, form the whole. Not having been able to obtain plates larger than 25 × 25 centimetres (10 inches) the constructors of the apparatus have been compelled to reduce the dimensions of the principal trough, but when larger plates are manufactured, the capacity of the trough may be increased without inconvenience, the space occupied may then be reduced.

We should be able to refer to the single trough thus described, as far as the electrolytic apparatus is concerned, but we prefer to continue the description, showing what the inventors call an *electrolytic group*, and so make the apparatus and its working fully intelligible.

An *electrolytic group* is composed of fourteen troughs such as we have described, arranged in two sets or rows. Each trough in each row is 75 centimetres (30 inches) apart from the next, and each row 1·20 metre (nearly 4 feet) from the other, so that each *group* will occupy a space of 9 metres (29½ feet) long, and 1·20 metre (about 4 feet) deep.

When several groups have to be employed, they can be arranged continuously on the same plane, or super-imposed, forming a sort of tower, or in any other manner which may be the most suitable to the shape of the space at disposal.

The troughs of each group communicate one with another by suitable tubes and taps, and the arrangement adopted is such that, if for

any reason one or other of the troughs have to be stopped working, the work goes on just the same in all the rest.

As will have been seen by the description, the electrolytic apparatus could not be more simple nor more easy to construct, the necessary elements being few, of no great weight, and easy to obtain, with the only exception of the dynamos and the carbon plates, which are all that have to be procured from abroad.

In addition to the troughs forming an electrolytic group, there are required a receptacle for juice, another for water, and a dynamo to supply the necessary amount of electricity, according to the number of groups which have to be constantly at work to produce the daily yield.

It is then indubitable that this apparatus is at least as simple as the greater part of those at present employed, and that the repairs which may be necessary will be as cheap and easy to effect as can be desired.

Let us now see how the apparatus works.

The juice obtained from the mill or diffusion battery is conveyed as at present to the receiving tank, care only being taken that it contains the least possible quantity of comminuted bagasse, and it would soon be better to filter it before being submitted to the electrolytic process, though this is not indispensable, the object being merely that the fibrous matter should not soil the troughs, and render more frequent cleaning necessary. As soon as the juice is in the tank, the necessary quantity is conveyed to the first trough of the group, into the central space or trough; at the same time water from the water tank being placed in the two lateral troughs, the only precaution being that both the juice and the water must be kept at the same level in the troughs. The dynamo is then set in motion, care being taken that the current increases in proportion to the quantity of juice which enters; and as the troughs communicate one with another they will all become filled until the liquid reaches the desired level; from that moment the group is charged and nothing is necessary but to regulate the flow of the juice in such a manner that on reaching the last trough it shall be defecated, that the water shall not be saturated with salts, and that its level shall be equal to that attained in the central trough.

The group being charged, its working is continuous and automatic —that is to say, the defecation is effected without the hand of man having to attend to anything except to maintain the regularity of the

current, and that the quantity of the juice and water shall be the same.

Having thus roughly described the working of one group, the explanation applies to as many groups as may be used, premising that each group effects the defecation entirely independently of the others; and the juice from the different groups being collected in one receiver, it will be ready for the further processes of the factory.

The electrolytic defecation differs from the present system in the apparatus and the process employed. At present we employ as many defecators as are necessary for the quantity of juice contained in the crushing-mill. By the new electrolytic process we shall employ as many groups as are necessary according to the quantity of juice. By the present process we have to heat the juice even to the boiling point, expending an enormous quantity of steam; by the electrolytic process we work with cold juice. Under the present system we use lime as the defecating substance, with its thousand and one inconveniences, empiricism, and uncertainty, and, as we have said in the preceding article, without obtaining a perfect defecation. By the electrolytic process we use electricity as the defecating agency, which effects a veritable defecation, for it eliminates all the potash and soda salts, precipitates the albumen in an insoluble state, and this with absolute certainty and an entire absence of any troubles attending the operation.

In which of the two systems are the advantages the greatest? Undoubtedly, on that of the electrolytic process of Messrs. Maigrot and Sabatés.

Unquestionably, the apparatus employed is at least as simple as the defecators, with the advantage of being cheaper; the management is also easier than that of the defecators, because it works automatically, no reactions of any kind being employed; that the electrolytic defecation is cheaper than the present process is beyond a doubt, because the juice does not require heating, and the production of the necessary electricity is much more economical than the cost of heating the juice, as we shall show later on; finally, the certainty of the result is of very great importance, and all the more so, as we have already said, as the better defecation will give a not insignificant increase of yield.

The electrolytic defecation is effected in the apparatus just described in the following manner:—

As we have said, the juice traverses the central trough, in which is the carbon plate which forms the positive electrode, and in the lateral troughs are water and the carbon plates which form the negative electrode, the juice being separated from the water by the thin wall of pergament paper, there results from the passage of weak currents, that the potash and soda salts are decomposed; the mineral and organic acids which principally predominate remain in the juice, and the potash and soda bases passing through the thin wall of pergament paper are dissolved in the water; in the central troughs, in proportion as the decomposition of the salts proceeds, the juice becomes more acid, and the water in the lateral troughs more alkaline, and it is evident that when the decomposition has reached its limit all the salts of potash and soda will have become decomposed, their bases passing into the lateral troughs, leaving the juice free from potash and soda salts and in an acid state. If the process were effected under heat, these organic and mineral acids would attack the sugar, but in working with cold juice all fear of this is completely removed.

The acid juice is conveyed to a tank, where it is neutralized by means of lime, and the salts of the acids contained in it are precipitated cold, thus remaining insoluble. The juice is then filtered, either in filter presses or in any other kind, or by the special coke filters of the inventors, the juice resulting being clear, and without any other salts than the soluble ones of lime or magnesia, which, as we have already stated, do not hinder the crystallization of the sugar.

The precipitation of the albumen and its derivatives is effected by a decomposition which it undergoes by the action of the electric current in the acid juice and the ozonised nascent oxygen, and is completed by the addition of lime to neutralize the juice.

We will not enter into further theoretical details on this point, not thinking it necessary to do so; but if anyone should desire it, we are ready to give whatever explanations may be asked.

We believe we have sufficiently explained the electrolytic process of defecation; it remains now to give the figures and data relating to manufacture which are necessary for the proper comprehension of the system, which we shall do in our next article, in which we shall also deal with everything which bears upon electricity applied to defecation.—*La Revista de Agricultura.*

NOTICES OF BOOKS.

(Continued from March number.)

Proposition for a New Method of Naming the Various Cuttings of the Stem of the Sugar Cane. By Dr. Franz Benecke. With four figures on one sheet.

This is a pamphlet of eight pages, devoted to an endeavour to introduce a regular and intelligible nomenclature for the various portions of the cane plant, which, it appears, were very differently named in various parts of Java. As we cannot reproduce the coloured engravings which accompany this pamphlet, we fear we could scarcely make any intelligible extracts, although we should have liked to do this, as Dr. Benecke closes with the remark that he would be glad to receive from other cane-cultivating colonies some information as to the names given to the different "cuttings" (French "*boutures*") into which the cane is divided.

The Weight and Extent of the Roots of the Sugar Cane. By Dr. Franz Benecke.

This little pamphlet of ten pages is an account of experiments made to ascertain the weight and dimensions of the roots of an average cane plant, and the extent of ground occupied by them, which, he says, may by some be regarded as a mere piece of scientific pedantry on his part, but which, in reality has a very serious side, the figures and data being full of instruction for practical men, for whom it is intended.

Is it Possible to obtain Sound Canes from Typical "Sereh" Cuttings? An Answer to this question (propounded by Dr. L. Ostermann, after some experiments). By Dr. Franz Benecke. With two figures on one sheet.

This is another pamphlet of a similar size to the last, the inducement for writing which was supplied by an experiment made by Dr. Ostermann, consisting in planting 23 cuttings of cane which presented unmistakable signs of the "Sereh" disease. A portion of these were totally destroyed by the white ants (termites), some of the rest suffered from them, but enough remained to show that, in one instance at least, a tolerably fine plant with twelve canes was obtained. Dr. Benecke considers the enquiry, as he puts it,

cannot be answered affirmatively, because he maintains that "so long as the cause of the 'Sereh' disease is unknown, and we do not know with certainty which of the diseased phenomena observed is a consequence of the 'Sereh' disease, we cannot certify accurately any plant as sound, or free from 'Sereh.'"

But if the question is altered to "Is it possible to obtain productive sugar canes from typical 'Sereh' cuttings?" then we may answer in the affirmative. Dr. Benecke has not much faith in the trials with cuttings brought from the British East Indies, by Herr Kobus, to be planted in the island of Banka, because Herr Kobus has himself stated that typical "Sereh" plants are to be found in that island. He proposes that several sets of experiments should be instituted, similar to that of Dr. Ostermann, so as to distinctly prove how far it may be possible to obtain good productive canes from even infected "cuttings," and to try carefully how far good manuring, and careful culture, will get rid of the "Sereh." In face of the enormous loss sustained by the Java planters through the "Sereh" and the failure hitherto of canes introduced from elsewhere to be proof against the infection, it seems well worth trying the experiments in question, to see whether the native Java canes cannot be so "educated" as to stand against the disease, and, as it were, "live it down."

(To be continued.)

Timehri: Being the Journal of the Royal Agricultural and Commercial Society of British Guiana. Volume IV. New Series. Part II.

The second part for 1890 of this very instructive and entertaining periodical has now reached us. The first paper, "The Post Office in British Guiana before 1860," by James Rodway, F.I.S., is exceedingly interesting, and carries us back to days that seem to many of us unreal, when "a 'single' letter—*i.e.*, one sheet—cost 1s. for ocean postage, while the Deputy Postmaster at Berbice charged 1s. 8d. for receiving it and delivering it when called for." In 1850 postage stamps came into use, and Mr. Rodway makes the statement in regard to the 2 cent stamp of this issue—which is so rare as to fetch fabulous sums whenever a specimen is to be had—that a delivery of letters twice daily through the principal streets of the city was inaugurated 1st March, 1851, this stamp representing the extra fee for delivery, but it was discontinued soon after. Many good stories

and facts are related in illustration of the article. A paper on "Fire-flies," by Lady Blake (wife of the Governor of Jamaica), is original and well written. The remaining papers are, as might be expected, chiefly of local interest, with the exception of one by Prof. Harrison on the familiar topic of Sugar Cane Experimental Stations, a portion of which we have reproduced on page , for the reasons there given.

Economic Plants: An Index to Economic Products of the Vegetable Kingdom in Jamaica. Compiled by William Fawcett, B.Sc., F.L.S., Director of Public Gardens and Plantations, Jamaica. Government Printing Establishment, Kingston.

This useful publication, compiled, as the editor states, somewhat hurriedly so that it might be available for reference during the exhibition, is an indication of the practical development of a movement which has been going on for some years, in the direction of the various Colonies becoming acquainted with the respective vegetable productions of the countries, which are or might be available for economic and industrial purposes. This movement, if it did not entirely originate, has to a great extent been fostered by the work carried on at Kew, and the visit of Mr. Morris to the West Indies, as is evident from the lectures and addresses which he has already delivered in Jamaica and other islands, cannot fail to give it a strong impetus. The brochure before us is, as far as we can judge, well drawn up, and is calculated to form one of a valuable series of reference books on these topics.

Manuel-Agenda des Fabricants de Sucre, &c. Deuxième Edition, entièrement refondue et considérablement augmentée. Par Ch. Gallois, Ingénieur des Arts et Manufactures, et F. Dupont, Chimiste. Chez les Auteurs, Paris, 81, Rue de Maubenge, et 37, Rue de Dunkerque.

We have received from the compilers the above very handy small volume of 500 pages, which is a complete and amplified revision of the book issued by the same compilers in 1889. In the revised edition advantage has been taken of all the new methods discovered and the progress achieved by the sugar industry, whether from a mechanical or scientific point of view; and the volume forms an exceedingly complete and compact book of reference on the way in which the sugar manufacturer, manager of sugar works or refinery,

or sugar chemist, may best conduct his operations. Naturally, the French manufacturer, &c., will be the one to make the most profitable use of the book, but cane sugar is treated on as well as beet, and we can safely recommend the manual to all connected with the trade who are acquainted with the French language. The volume may be carried in the coat pocket, and we do not know that any so complete work of the kind in so small compass is in existence in this country. The book may be procured direct from the Editors, at the addresses given above; or from the publisher, J. Michelet, 23, Quai des Grands Augustins, Paris.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. THOMPSON, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; 63, Long Row, Nottingham; and 323, High Holborn, London.

ENGLISH.

APPLICATIONS.

1826. H. L. DOULTON, London. *Improvements in filters.* 31st January, 1891.

2083. C. H. FITZMAURICE, London. *Improvements in apparatus and appliances for softening, purifying, and filtering liquids.* 4th February, 1891.

2766. M. S. ORR, Dublin. *Measuring syrups and other liquids into mineral water and other bottles or vessels.* 16th February, 1891.

2796. C. W. GUY, London. *Improvements in and relating to crushing mills.* 16th February, 1891.

3004. S. H. JOHNSON and C. C. HUTCHINSON, London. *Improvements in the method of and apparatus for forcing semi-fluids into filter presses.* 19th February, 1891. (Complete Specification.)

3151. H. W. FRY, London. *Improvements in apparatus for crushing or pulverising grain of all kinds, and other substances.* 20th February, 1891.

3223. W. A. WHITE, Birmingham. *An appliance for infusing tea and other substances, the same appliance to be used also as a sugar-sifter.* 23rd February, 1891.

ABRIDGMENTS.

2774. JOHN IMRAY, of 28, Southampton Buildings, Chancery Lane, London. (A communication from abroad by La Société Nouvelle des

Raffineries de Sucre de Saint Louis, of Marseilles.) *Improvements in centrifugal machines.* Dated February 20th, 1890. This invention relates to that class of centrifugal machines which act continuously. The web of filtering material is carried upon rollers in such manner that it may be revolved and cleaned by means of brushes and streams of liquid. The revolving drum of the machine is divided into a number of segmental compartments, each having a separate filtering and cleaning device. The various movements are transmitted from the main shaft by bevel, &c., gearing.

3907. ROBERT HARVEY, of the firm of Mc.Onie, Harvey & Co., engineers, Scotland Street, Glasgow. *Improvements in and relating to evaporating apparatus.* March 12th, 1890. This invention is specially applicable to multiple effect vacuum apparatus in which the various evaporating vessels are placed vertically side by side. The liquor or juice passes through a series of steam-heated tubes in the said vessels, and the steam arising from the evaporation in one vessel is utilized to evaporate the juice, &c., in the next vessel, a constantly increasing vacuum being maintained in the series. The novelty of the invention appears to lie in the fact that the steam is admitted to heat the tubes both at the upper and lower ends thereof. Deflecting plates are also used among the tubes to cause a proper circulation of the steam.

19110. J. A. MORRELL, of Lonsdale, Pennsylvania, United States, America. *Improved method of, and apparatus for, evaporating and concentrating solutions.* November 25th, 1890. Several forms of the invention are shown. The simplest consists of a vertical pipe up which the solution under treatment pssses, and in which it is heated by means of a steam jacket. The liquid (which may be charged with gas) issues from the pipe in a series of films or sprays into a space, the temperature of which is kept up by superheated steam. The gist of the invention appears to be sudden release of the liquid under pressure into a highly heated chamber, in such manner that nearly instantaneous evaporation is effected.

10893. ROBERT PZILLAS, of Breig, in the Regency of Breslau, Germany, manufacturer. *Apparatus for drying sugar or like substances.* July 12th, 1890. A number of sectional wagons open only at their ends, are placed end to end and locked so as to form a continuous channel. Each wagon is provided with shelves, upon which the substance to be dried is spread, and a stream of hot air is

passed through the whole series. The air is heated by passing through a terminal chamber having steam heating plates, being drawn through by a fan in a terminal chamber at the other end. All the wagons, as likewise the two chambers, are movable upon a line of rails, so that the length of the channel may be varied to suit different requirements. The feeding and withdrawal of the material is effected by changing the position of the wagons in succession.

18751. OTTO SCHULZ, of Brieg, in the Kingdom of Prussia, German Empire, Sugar Works Inspector. *Improvements in continuous evaporating apparatus.* November 20th, 1890. A number of open pans having double bottoms is arranged one above the other in an outer casing. Live steam is admitted into the double bottoms of each pan and caused to circulate therein by baffles. The liquor flows slowly from pan to pan, and being heated by the steam is evaporated, the products passing off through a common opening. Suitable fittings, such as gauges, valves, &c., are provided in desirable places.

GERMAN.

ABRIDGMENTS.

53816. JACQUES PIEDBOEUF, Aix-la-Chapelle. *Improvements in evaporating apparatus:* Already protected under No. 50387. 6th April, 1890. This evaporating apparatus, already protected under Patent No. 50387, is altered in that the collecting chamber is placed above the dome, and is connected by means of a central pipe with a chamber which serves for the collection of the rob and steam evolved therefrom.

53408. FR. DEMMIN, Berlin. *Improvements in sugar centrifugals.* 19th December, 1889. (Addition to Patent No. 50412, 13th February, 1889.) A regulating apparatus is inserted between the centrifugals and the collectings vessels for the centrifugalled syrup. This apparatus consists of a series of three way cocks or slide valves, the connecting passages of which, when connection is made for the inflow or discharge of the syrup, form a straight direct pipe-conductor. In this way the remainder of the casing syrup is prevented from accumulating in the regulating apparatus, and thus the partial mixing of syrups of different degrees of purity is avoided.

54006. J. T. COCU, La Fère, Dep. de l'Aisne. *Improved knife shredder applicable for beetroot and the like.* 7th April, 1889. The edge of this shredder is provided with teeth on its under side, while the upper remains smooth,

54059. Thomas Slaiter, London. *Vacuum evaporating apparatus.* 17th May, 1889. A number of pipes is fixed longitudinally of the vacuum apparatus, which are open at the top and closed at their ends. Troughs and return pipes are fixed in these pipes through which the liquid to be evaporated flows, the steam surrounding the above mentioned troughs and return pipes. The action of the machine is as follows:—The liquid to be evaporated flows through one of the uppermost pipes over into one which contains one of the troughs, and then sinks through a connecting piece to the return pipe. From this point the liquid flows through another connecting piece to another pipe and trough placed lower in the series. The repetition of the evaporating process depends upon the number of single evaporators placed over one another.

54100. R. Ch. Garton, Ch. H. Garton, and W. Lawrence, London. *Evaporating apparatus.* 29th August, 1889. The pipes of this apparatus are not smooth, but are of a helical or spiral shape.

54115. R. Rzillas, Brieg, Reg-Bez, Breslau. *Improved machine for pressing sugar strips.* 24th September, 1889. The sugar strips in this machine are pushed out by the stamp, laid at even distances apart, and conveyed by the same into the depositing board. By the aid of this board the machine is set in and out of gear automatically, for when the board is empty it sets the machine in motion, and when it has its complement of sugar strips it stops the machine.

54165. H. Andree, Nauen. *Improvements in centrifugals applicable for sugar masse-cuite and the like.* 30th April, 1890. In this centrifugal the syrup is not discharged over the whole outer surface of the drum, but only through a discharge opening, which is formed of a row of holes placed in the middle of the drum. It then empties itself into a drain collector which surrounds the inside casing of the centrifugal jacket. The centrifugal sieves are laid upon indented rivetted vertical bars, so that a space remains between them and the drum through which the syrup passes on its way to the discharge opening.

54359. Alexander Komorowski, Sojki, Gouvernement Warschau, Russia. *Process for regulating the alkalinity of sugar juices and thereby increasing their marketable value.* 19th February, 1890. After the *masse-cuite* has been reduced by boiling to a granular condition, its alkalinity is raised by adding to it, while in the vacuum boiling-down apparatus, from 0·1 to 0·8 per cent. milk of lime or soda solu-

tion. The syrup which surrounds and adheres to the grains of sugar is thus diluted, and small loose pieces of crystallised sugar are prevented from forming, thereby rendering the process of centrafugalling easier.

54364. August Mayer, Hatvan, Hungary. *An osmose regulator.* 6th May, 1890. By this osmose regulator the cross section of the pipe for conveying the syrup or the osmose water is narrowed or widened by means of a pawl, which is actuated by a float, which, according to the consistency of the liquid, either rises or falls. This pawl can also be so arranged between both pipes that it simultaneously widens the opening in the one pipe and narrows the other.

54372. Drost & Schulz, Breslau. Addition to Patent No. 50100, 15th November, 1888. *Process for the production of crystallized sugar in raw sugar works.* 25th December, 1889. Instead of making use of the beet root raw rob for casing the raw sugar, the inventors now use juice, to which, by mixing with masse cuite or raw sugar during the casing in the centrifugal, the necessary concentration (specific gravity 1·325) is imparted, or a casing liquid which is produced by the addition of purified raw juice or water to the masse cuite already crystallized out.

BEET SUGAR—1890-91.

Latest Estimates of Production.

	Licht.	Deutsche Zucker-Ind.	Prazer Zuckermkt.	Goerz.
	Tons.	Tons.	Tons.	Tons.
German Empire	1,335,000	1,290,000	1,300,000	1,300,000
France	700,000	700,000	730,000	680,000
Austria-Hungary	760,000	730,000	690,000	730,000
Russia	530,000	520,000	525,000	500,000
Belgium	200,000	177,000	175,000	155,000
Holland	65,000	110,000	58,000	62,000
Other Countries	80,000		29,000	40,000
Total	3,670,000	3,527,000	3,507,000	3,467,000

IMPORTS AND EXPORTS (UNITED KINGDOM) OF RAW AND REFINED SUGARS.

JANUARY 1ST TO FEBRUARY 28TH.

Board of Trade Returns.

IMPORTS.

Raw Sugars.	Quantities.		Value.	
	1890.	1891.	1890.	1891.
	Cwts.	Cwts.	£	£
Germany	964,659	832,169	549,607	507,054
Holland	86,332	59,154	45,254	33,462
Belgium	206,890	265,837	101,217	156,981
France	458,305	371,311	274,768	240,239
British West Indies & Guiana	270,310	234,691	212,378	186,474
British East Indies	46,000	63,660	20,185	36,039
China and Hong Kong	....	....	....	....
Mauritius	50	17,330	44	10,474
Spanish West India Islands	....	....	....	....
Brazil	78,326	216,529	45,978	127,722
Java	46,705	240,215	35,245	177,832
Philippine Islands	30,200	198,898	14,735	104,950
Peru	170,536	100,360	116,418	70,124
Other Countries	65,072	83,138	46,695	57,368
Total of Raw Sugars	2,423,385	2,683,292	1,462,524	1,708,719
Molasses	14,950	45,014	5,871	16,244
Total Sugar and Molasses	....	....	2,772,434	2,961,408
Refined Sugars.				
Germany	729,844	778,890	593,175	624,173
Holland	271,861	219,991	226,020	184,484
Belgium	29,924	35,420	26,664	30,320
France	571,304	355,094	457,539	295,506
United States	282	120,995	568	101,000
Other Countries	98	1,201	73	962
Total of Refined	1,603,313	1,511,591	1,304,039	1,236,445

EXPORTS.—Refined Sugars.

	Cwts.	Cwts.	£	£
Sweden and Norway	13,502	9,685	9,541	7,467
Denmark	16,132	19,751	9,314	12,301
Holland	15,268	17,074	10,820	12,014
Belgium	4,522	3,690	3,038	2,548
France	555	14	390	12
Portugal, Azores, & Madeira	18,096	15,580	11,540	10,632
Italy	18,391	7,134	11,916	4,881
Other Countries	35,136	38,560	26,031	29,809
Total of Exports	121,602	111,488	82,590	79,664

IMPORTS OF FOREIGN REFINED SUGAR.

The British Sugar Refiners' Committee furnish us with the following figures, giving the imports of foreign refined sugar for the month of February, 1891, compared with the corresponding month of the two preceding years, and the average monthly imports for the past year compared with those of 1887, 1888, and 1889, distinguishing the quantities of "Lumps and Loaves" from "other sorts," and giving the separate imports from each country:—

Countries from which Sugar has been imported.	"Lumps and Loaves."							"Other Sorts." Including Crushed Loaf, Granulated, Crystallized, &c.							Total.						
	Monthly Average.				Feb.	Feb.	Feb.	Monthly Average.				Feb.	Feb.	Feb.	Monthly Average.				Feb.	Feb.	Feb.
	1887	1888	1889	1890	1889	1890	1891	1887	1888	1889	1890	1889	1890	1891	1887	1888	1889	1890	1889	1890	1891
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France.............	1363	1686	2373	2707	1734	2954	1673	5099	4855	8596	8547	3224	5169	5587	6462	6541	10969	11254	4958	8123	7260
Holland	3780	3267	2294	2858	3497	2725	3777	2483	2675	3354	4580	2905	3536	4200	6263	5942	5648	7438	6402	6261	7977
Germany & Austria ..	1347	1510	2573	2512	2546	2862	2746	10463	11729	13844	18333	11614	14897	19543	11810	13239	16417	20845	14160	17759	22289
Belgium	592	622	827	390	730	381	781	308	227	225	344	186	312	493	900	849	1052	734	916	693	1274
United States	454	8	..	96	..	..	17	2804	157	42	1123	42	13	2552	3258	165	42	1219	42	13	2569
Russia..............	3	..	23	25	..	..	..	452	1959	2015	29	5526	..	..	455	1959	2038	54	5526	..	..
Other Countries	..	1	239	..	..	..	..	15	2	355	..	6	..	..	15	3	594	..	6	..	..
Total	7539	7094	8329	8588	8507	8922	8994	21624	21604	28431	32956	23503	23927	32375	29163	28698	36760	41544	32010	32849	41369

SUGAR STATISTICS—GREAT BRITAIN.

FOR THE FOUR PRINCIPAL PORTS.

To March 21st, 1890 and 1891.

In Thousands of Tons, to the nearest Thousand.

	STOCKS.		DELIVERIES.		IMPORTS.	
	1891.	1890.	1891.	1890.	1891.	1890.
London	30	35	65	65	69	51
Liverpool ..	36	63	72	66	56	43
Clyde......	41	45	42	47	48	51
Bristol	2	2	15	16	13	16
Total ..	109	145	194	194	186	161

The above figures do not represent accurately, or to the full extent, the position and movements of sugar in the United Kingdom, as Hull, Leith, &c., are not included, there being no published returns for these ports.

SUGAR STATISTICS—UNITED STATES.

(From Willett & Gray's Report.)

For the four principal Ports. In Thousands of Tons, to the nearest Thousand. For February, 1890 and 1891.

	STOCKS. March 1st.		DELIVERIES. In Feb.		IMPORTS. In Feb.	
	1891.	1890.	1891.	1890.	1891.	1890.
New York	22	4	67	52	66	54
Boston	4$\frac{1}{2}$	3	12	7	10$\frac{1}{2}$	10
Philadelphia....	2	..	22	30	23	30
Baltimore	..	..	2	..	2	..
Total......	28$\frac{1}{2}$	7	103	89	101$\frac{1}{2}$	94
Total for the year..........			194	190	194	186

NEW YORK PRICES FOR SUGAR.

From Willett & Gray's Report, March 19th, 1891.

Fair Refining.	96o/o Centfs.	Granulated.	Stand. A.	Stock in Four Ports.
Mar. 19, 1891.—5 1-16c.	5 11-16c.	6$\frac{1}{4}$c.	6$\frac{1}{4}$c.	Jan. 1, 1891— 27,756 tons.
Mar. 20, 1890.—5 3-16c.	5 11-16c.	6 5-16c.	5-15-16c.	Jan. 1, 1890— 11,169 tons.
Mar. 21, 1889.—5$\frac{1}{4}$c.	6c.	7$\frac{1}{4}$c.	7c.	Jan. 1, 1889— 32,254 tons.
Mar. 22, 1888.—4$\frac{3}{4}$c.	5 7-16c.	6$\frac{3}{4}$c.	6$\frac{1}{2}$c.	Jan. 1, 1888— 47,798 tons.
Mar. 24, 1887.—4 9-16c.	5$\frac{1}{8}$c.	5$\frac{3}{4}$ 13-16c.	5$\frac{5}{8}$ 7-16c.	Jan. 1, 1887—102,279 tons.
Mar. 25, 1886.—4$\frac{7}{8}$c.	5$\frac{1}{2}$c.	6 3-16-$\frac{1}{4}$c.	5$\frac{3}{4}$-81c.	Jan. 1, 1886— 57,328 tons.
Mar. 26, 1885.—4$\frac{5}{8}$c.	5 5-16c.	5 15-16-6c	5$\frac{5}{8}$ 9-16c.	Jan. 1, 1885— 89,186 tons.
Mar. 20, 1884.—5 9-16c.	6 7-16c.	7 5-16c.	6 13-16c.	Jan. 1, 1884— 60,900 tons.
Mar. 22, 1883.—7 1-16c.	7 13-16c.	8$\frac{3}{4}$c.	8$\frac{1}{4}$c.	Jan. 1, 1883— 50,297 tons.
Mar. 23, 1882.—7$\frac{1}{4}$c.	7 15-16c.	9$\frac{3}{8}$c.	9$\frac{1}{8}$c.	Jan. 1, 1882— 43,927 tons.

Stocks of Sugar in the Chief Markets of Europe on the 28th February, 1891, for Three Years, in thousands of tons, to the nearest thousand.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal entrepôts	Total 1891.	Total 1890.	Total 1889.
112	525	317	335	59	28	1376	1332	846

Twelve Months' Consumption of Sugar in Europe for Three Years, ending 28th February, in thousands of tons, to the nearest thousand.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal entrepôts	Total 1891.	Total 1890.	Total 1889.
1337	528	506	308	58	383	3120	2889	2790

Estimated Crop of Beet Root Sugar on the Continent of Europe for the present Campaign, compared with the actual crop of the three previous Campaigns.

(From Licht's Monthly Circular.)

	1890-91. Tons.	1889-90. Tons.	1888-89. Tons.	1887-88. Tons.
German Empire..	1,335,000 ..	1,264,607 ..	990,604 ..	959,166
France	700,000 ..	753,078 ..	466,767 ..	392,824
Austria-Hungary.	760,000 ..	787,989 ..	523,242 ..	428,616
Russia	530,000 ..	456,711 ..	526,387 ..	441,342
Belgium........	200,000 ..	221,480 ..	145,804 ..	140,742
Holland........	65,000 ..	55,813 ..	46,040 ..	39,280
Other Countries..	80,000 ..	80,000 ..	87,000 ..	79,980
	3,670,000	3,619,678	2,785,844	2,481,950

Mr. Licht has more than once expressed the opinion that the official German figures for December would turn out too low and now raises the estimate by 10,000 tons, which he still considers as a minimum. The estimates of other statisticians will be found on another page.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

The month just closed has been characterised by a steady and fairly maintained demand for cane sugars of most kinds, which were somewhat scarce. Prices are advanced all round, and may be quoted 6d., in some cases even 9d. higher for the better sorts, and 3d. for low West and East India sorts.

The refined market was active up to the middle of the month, and an advance of 6d. to 9d. per cwt. has been established all round, which is likely to continue, as the margin of profit must be very small.

Beet has been in active demand, and may be quoted about 3d. higher than last month. An increase in Europe in the amount of land under beet cultivation seems likely, though in Holland, in consequence of the new law just passed, there is certain to be a diminution. The Americans are said to be buying largely in beet sugar, and we think increased firmness in this market may be looked for, particularly as stocks are not large in any European country.

Present quotations for the standard qualities, as under, are:—

Floating.			Last Month.
Porto Rico, fair to good Refining	13/6 to 14/6	against	13/- to 14/-
Cuba Centrifugals, 97°/o polarization	15/6	,,	15/-
Cuba, fair to good Refining	13/9 to 14/-	,,	13/- to 13/6
Java, No. 14 to 15 D.S.	15/9 to 16/-	,,	15/3 to 15/6
British West India, fair brown	13/-	,,	12/9
Bahia, low to middling brown	11/- to 11/6	,,	11/- to 11/6
,, Nos. 8 to 9	12/6 to 13/-	,,	12/3 to 12/9
Pernams, regular to superior Americanos..	11/9 to 13/6	,,	11/6 to 13/-

Landed.			Last Month.
Madras Cane Jaggery..	10/6	against	10/3
Manila Cebu and Ilo Ilo	10/3	,,	10/-

Paris Loaves, f.o.b...	18/-	against	17/3
Russian Crystals, No. 3, c.i.f.	15/9 to 16/-	,,	15/4½
Titlers	18/9	,,	18/-
Tate's Cubes..	20/6	,,	20/-
Beet, German and Austrian, 88%, f.o.b. ..	13/10½ to 14/-	,,	13/9

THE SUGAR CANE.

No. 262. MAY 1, 1891. Vol. XXIII.

☞ The writers alone are responsible for their statements.

All communications to be addressed and all cheques, &c., made payable to "Edward Sutton, Editor of The Sugar Cane, Manchester," which address is sufficient.

For Table of Contents, see page i.

We gave last month the results of the Caffery (Louisana) Central Factory's working, and now learn that in consequence of the fine work done by their seven-roller mills, they are about to set up another, dispensing in this case with the third set of rollers, and making up by increase of length in the new mills, the dimensions of which will be: first three rolls, 7ft. long by 32in. diameter, and the second (two rolls) 7ft. 3in. long by 44in. diameter, with saturation of bagasse with hot water between the two sets of rollers.

The Louisiana preduction this year is expected to be over 210,000 tons, and will thus considerably exceed the estimates of most of the leading statisticians.

There was an unprecedented demand in New York for refined, and at the date of our last advices none could be bought except perhaps granulated, with any prospect of delivery in less than a fortnight. American Sugar Refining Company's shares, which on the 1st April were $80\frac{3}{4}$ and $87\frac{3}{4}$, rose to 92 and 93 on the 10th, and closed at $89\frac{1}{8}$ and $91\frac{1}{8}$ on the 15th, for common and refined respectively.

It is quite evident from the facts which are being published that the question of mill-work *v.* diffusion is not yet nearly settled. Reports from many of the sugar-houses do not show satisfaction with the results obtained.

According to a South-African paper, the value of sugar exported from Natal last year, as given by the Durban Chamber of Commerce, was only £20,000, against £90,000 in the preceding year. The *Natal Mercury* thinks that, if this is true, the thousands that have

been spent in importing coolies to assist the planters have been wasted.

Demerara is about 3,000 hhds. of sugar behind last year at this time in regard to quantity exported.

Barbados reports are far from satisfactory. Rain is much wanted there and in Jamaica.

A correspondent of the *European Mail* expresses the opinion, which we shall all agree with, that, in spite of the bounties, cane sugar will continue to hold its own. The most encouraging feature is that while the productiveness of the beet, and the economical manufacture of beet sugar, have almost reached their limits, this is not the case with the cane as regards either factor.

Details from Reunion of the working of the apparatus for diffusion of bagasse erected there by the Anciens Etablissements Cail states that the loss of sugar has been materially reduced, and the bagasse, after passing through a single mill, is in good burning condition. The La Rivière works, which formerly got from 7 to 7½% of sugar on weight of canes, has now obtained 10·85%, an increase of 50%. We are not told that this is a result only of the new apparatus.

Results of the working of several factories in Russia show that they paid for 1889-90 dividends ranging from 30% to 5%, the mean figure for 26 factories being 15%.

Mr. George Stade, writing to the *Deutsche Zuckerindustrie*, states that a new variety of cane has been met with in the Fiji Islands, on the Rewa river, the principal special characteristics of which are:— Its growth is perfectly upright, like that of a bamboo bush; it requires about 14 months for ripening, attaining a height of 12 to 12½ feet; the leaves are of a less woody structure than ordinary canes, and are easily stripped off; the rind is so hard that the rats leave it almost untouched. Experiments are being made by the Colonial Sugar Refining Company, and by the Queensland Agricultural Department.

The newly planted canes in Madeira are doing well, and the crop about to be cut will be the first of any consequence for a period of seven years.

We would call special attention to interesting papers on "Results obtained in central cane sugar factories by different methods o working," and on "Estimated possible cost of production in the West Indies," which will be found in the present issue.

THE COST OF SUGAR IN FRANCE AND GERMANY.

Under the above heading the able Editor of the *Journal des Fabricants* has written an article which is of some value for the comparative history of the sugar industry, so that we think it advisable to translate it for future reference, more especially as the question of whether beet sugar can, from a commercial point of view, be successfully produced in England, seems to be again coming to the front. For convenience we have converted francs into English money at the rate of 25 francs equal to £1 sterling.

Referring to an article by the Editor of the *Deutsche Zuckerindustrie*, on the question of the principal expenses per 1,000 kilos. (2,200 lbs.) of beets in the two countries, M. Dureau proceeds to examine in detail the figures given in that journal.

The following are the bases of calculation adopted by M. Hager for 1889-90:—

	France.	Germany.
Price of beets, per 1,000 kilos. (2,200 lbs.) ..	22s. 0¾d.	22s. 0¾d.
Percentage of yield obtained, in raw sugar ..	11·68	12·60
Coal used per 1,000 kilos. (2,200 lbs.) of beet	441 lbs.	443 lbs.
Price of coal per 1,000 kilos.	16s. 5d.	19s. 0½d.
Workmen's wages per day	2s. 11½d.	2s. 3¾d.

On these bases he calculates as follows the principal expenses per 1,000 kilos. (2,200 lbs.) of beet:—

	France.		Germany.	
	s.	d.	s.	d.
Beet	22	0¾	22	0¾
Coal	3	3½	3	10
Labour	1	10¾	1	5½
	27	3	27	4¼

The outlay in France would thus be fr. 33·97 for 116k.80 of sugar, equal to 23s. 4d. per 220½ lbs., and in Germany fr.34.10 for 126 kilos. of sugar, equal to 21s. 8½d. per 220½ lbs., or 1s. 7½d. less per sack of sugar than in France.

The advantage on the side of Germany would thus be insignificant, and the superiority which that country formerly possessed over France would, so to say, have ceased to exist.

Let us examine this question. Consulting, for France, the official sources (Bulletin de Statistique du Ministère des Finance) for the campaign of 1888-89, the latest of which the results are known, we

find that the average wage for men employed in the sugar factories was 2s. 11½d. per day; for women about 1s. 6½d.; for children about 1s. 4½d. Multiplying the number of working days by the rate of wages, we find that the amount paid for labour was 14,357,482 fr. 35 for working up 4,223,000 tons of beets = 3 fr. 40 (2s. 8¾d.) per 1,000 kilos of beets.

The amount of coal consumed was 840,521,931 kilos., equal to 200 kilos. per ton of beets, the ton of coal having cost, on the average, 16s. 5½d.; the factories therefore expended 3s. 3½d. in fuel per 1,000 kilos. of beets.

The average price at which the beets were bought was, for the campaign of 1888-90, about 22s. 1d.

The after products attained amounted to 1,518,457 tons of pulp, being 36 per cent. of the weight of the beet, worth on the average fr. 6·02, equal to frcs. 2·16 (1s. 8¾d.) per 1,000 kilos. of beets,—and 163,877 tons of molasses, being 3·20 per cent. of the weight of beets. The price of these is not given; we will assume 9 fr. per 100 kilos., equal to fr. 3·51 (2s. 9¾d.) per 1,000 kilos. of beets.

Finally, the official yield in sugar (refined) was, for the whole of the factories, 9·77 per cent. of the beets. But as this yield includes the *décharge* of the molasses delivered to distilleries, which is 0·546 per cent. of the weight of beets, the real yield in merchantable sugar was only 9·770—0·546 =9·224 per cent. in refined, or 10·14 per cent. in raw.

The official documents are unfortunately silent on several points of great importance, amongst others, the general expenses of the sugar factories. This is a domain which is closed against the incursions of the excise, and, consequently, we have to content ourselves with approximate figures.

We have seen that the factories expended—per ton of beets—3s. 3½d. for coal, and 2s. 8¾d. for labour, or together, 6s. 0¼d. Undoubtedly, the other expenses for working staff, various articles of consumption, oil, grease, cloths, sacks, acids, maintenance, &c., &c., amount to a considerably higher figure. We think these outlays may be estimated at a minimum of 9fr. (7s. 2½d.), which makes a total cost of manufacture of 13s. 2¾d. per ton of beets.*

* This is certainly a minimum. In their report on the Exhibition of 1889, the Committee of Sugar Manufacturers of the Arrondissement of Cambrai stated it as fr. 18.84 (15s. 1½d.) per 1,000 kilos. of beets.

We thus have—

Expenses per 1,000 kilos. of beets:—

	s.	d.
Beet	22	1
Coal	30	3½
Wages	2	8¾
General Expenses	7	2½
	35	3½
Deducting from this:		
360 kilos (792 lbs.) of pulp...... 1s. 9¾d. 39 kilos (86 lbs.) of molasses.... 2s. 9¾d.	4	6½
We have........	30	9

as the cost price of 101 k. 4 of raw sugar = 30s. 3¾d. for the sack (100 kilos. = 220 lbs.) of sugar.

This cost price, owing to the manner in which the duty is levied, has to be reduced by the amount of the *bonis* (allowance or premium), which amounted to 10·48 fr. per 100 kilos. (8s. 4¾d. per 220 lbs.), or 11·50 fr. per 100 kilos. (9s. 2¾d. per 220 lbs.) of raw sugar. The cost price of the sack (220 lbs.) of sugar was therefore 21s. 1d.

Let us now see what are the conditions as regards the German production. Examining the results of the working of 113 sugar factories for 1888-89, as compiled by S. von Ehrenstein, we find that the average price of beets may be fixed at 22s. 0¾d. per ton, and the cost of manufacture at 9s. 7½d. (of which 1s. 11d. is for labour and 2s. 3d. for coal), which gives:—

	s.	d.
Beets	22	0¾
Coal	2	3
Labour	1	11
General expenses	5	5½
	31	8¼

The residuary pulp represents 51 per cent. of the weight of beets, and is worth 6s. 0½d. per 1,000 kilos., equal to 3s. 0¾d. per ton of beets; the molasses were worth on an average 6s. 2d. per 220 lbs., which for a production of 2½ per cent. of the weight of beets represents about 1s. 7¼d. per 1,000 kilos. of beets.

The income from pulp and molasses is thus 4s. 8d. per ton of beets. The expenses being, as we have seen, 31s. 8¼d., then remains 27s. 0¼d. for the extraction of 125·4 k. of raw sugar, which brings the cost price to 21s. 8½d. for 100 kilos. (220 lbs.) of sugar. On the other hand, the premium having been 2·12 m., the cost price of the sack of sugar is

brought down to 19s. 5d., against 21s. 1d. in France. There is there a difference between the natural cost price in the two countries of 8s. 10d. per 220 lbs., and between the cost price when the premium is deducted a difference of 1s. 8d. in favour of Germany.

It will thus be seen that we arrive at a very different conclusion from that of M. Hager (*Die Deutsche Zuckerindustrie*), that is, that the German manufacturers still possess an actual superiority over the French.

M. Dureau then proceeds to account, at some length, for this advantage. As the details do not specially concern us, it will be sufficient to indicate that he finds two causes for the superiority of the Germans, the first being the yield obtained from a given weight of roots, which is considerably greater than that obtained in France, having in 1890-91 been only 10 per cent. of raw sugar, against 12 per cent. in Germany. The second cause is the more economical working of the German factories, the difference per ton of beets worked up being as much as 3s. 7½d., and he considers that this is due to the remarkable concentration of the labour, indicated in the fact that the average production of their factories is 32,000 sacks of 220 lbs., whilst that of the French is only 18,300 sacks. The conclusion of the article is devoted to a justification of the premiums as hitherto granted and still existing, which is not of particular interest to the English reader.

GERMANY.

The debate on the new Sugar Duties Bill was resumed on the 27th ult., when the Secretary to the Treasury expressed the hope that some agreement would be come to on the present measure, otherwise the Government would probably feel themselves compelled to introduce a new one, the provisions of which might not be quite so favourable as this. The almost unanimous wish of the manufacturers is for the present law to remain in force unaltered. The *Deutsche Zuckerindustrie*, in reply to proposals which have appeared in certain newspapers, declares that, taking into consideration the state of matters in competing countries, the only possible answer of the manufacturers and agriculturists is a demand for a minimum allowance of 2 marks during the existence of premiums.

Various propositions are being made in modification of the Government proposals, but it appears little likely that either the latter or the amendments, of which notice has been given, will obtain a sufficient majority. From a German point of view, it appears to us exceedingly undesirable to endeavour to settle the Sugar Duties definitely until a clear understanding has been arrived at respecting the treaty of commerce with Austria, and it seems likely that the matter may have to be deferred until this has taken place.

ESTIMATED POSSIBLE COST OF PRODUCTION OF CANE SUGAR IN THE WEST INDIES.

Whether it is possible to produce cane sugar as cheaply as that made from beetroot is a question of immense importance to all concerned in the British colonies, and the following notes may be of some interest to those taking part in this controversy. Authoritative information as to the composition of cane grown in the West Indies not being obtainable, the writer assumes that sugar cane can be produced there under conditions found in other tropical colonies, where proof can be had of the figures here given as to the cost of the factory, the return of sugar, and the number of men required to do the work.

Taking for granted then, that in any of the West Indian islands, there are some owners of plantations in a suitable district who are not satisfied with their present returns, and who, desiring to produce sugar in greater quantity and at a lower cost, determine to follow the German system, their mode of procedure might be as follows. They would first seek to bring into combination, planters controlling an area of cane sufficient to keep in constant work a factory of moderate size, say, to work up 45,000 tons of cane in a season of five months—if there, as elsewhere, work can profitably be continued for that length of time—and we may assume that the requisite area, say 3,000 acres, can be obtained in a district of about sixteen square miles, that this district is sufficiently level to be traversed by a narrow guage tramway, and that a fairly central position for a factory can be obtained on the sea coast, or with an adequate water supply (for condensation), preferably, of course, on a harbour or navigable river. These conditions being fulfilled, and a capitalist—say an English or an American refiner—being found ready to provide the factory, and tramway, etc., if the planters could not command the necessary funds, a limited company would be formed, the articles providing that, after the planters had been paid for the cane at the cost of production and the capitalist had received interest on the sum he spent, the profits remaining should be divided in certain proportions among the parties interested, the planters' share being calculated on the weight of canes delivered by them respectively. These details being arranged, what would be the cost of the factory and the probable return?

To work up the quantity of cane mentioned, at the rate of about 2,100 to 2,200 tons per week, with continuous work night and day—

from 1 a.m. on Monday to 3 p.m. on Saturday—there should be provided a double crushing plant, say 60 by 32 with 22in. cylinders; and, if the cane be hard, an apparatus for tearing it up before it enters the first mill; the boilers must have about 200 to 250ft. of grate surface, or say 6,000 to 7,000ft. of heating surface, the triple effet, 7,000ft., and the vacuum pans about 1,000ft. of heating surface; and all should be arranged for economical work, French and German experience being profited by in laying out the factory. This plant, with all minor details completely arranged, and including a cheaply constructed iron building, should be erected for £50,000 to £55,000, if an accessible site were chosen and the builders had an interest in doing the work economically. Then for the conveyance of the cane, the following tramway plant would be needed: 10 miles permanent line, 2ft. gauge; 6 miles portable line; 400 waggons; and 2 locomotives, costing in all £20,000; if there were no special difficulties to overcome in laying the permanent line, and the Government sanctioned the crossing of roads and private landholders gave rights of way; allow then £10,000 to £15,000 for working capital, stores, and wharf if wanted, and we have a total expenditure of £80,000 to £90,000, but to be on the safe side this figure can be made £100,000—a sum which would certainly be sufficient to render unnecessary any advances to the company on a mortgage of their property.

The factory being completed in good time for starting at the commencement of the season, we have to consider what would be the out-turn of sugar, and the cost of this.

As to the former, it may be said, that if the cane be of good quality—such as can be found in the Sandwich Islands, Mauritius, or Java,—the yield should be from 12½ to 14¼ per cent. of the weight of the cane in refining sugar (88 per cent. net titre), or, say, 1 ton of sugar to from 7 to 8 tons of cane; and from 45,000 tons of cane there should thus be produced between 6,400 and 5,600 tons of sugar, or say 6,000 tons, provided the mill can be worked for five months before the wet season sets in.

Then as to the expenses, it may be assumed that 12s. per ton will pay the planter for growing the cane and give him fair interest on his capital, and that for this price he can put the cane in trucks on the main line of tramway, traction to the mill will then cost 3d. per ton (wear and tear, and interest on plant being excluded), the wages

of the men in the factory, including the engineers, will be under 1s. 3d. per ton (90 to 120 hands being needed for night and day work, according to the class of labour employed); the coal used will cost 1s. per ton of cane, the rate of consumption being 1 ton to 30 tons of cane; salaries will represent about 10d. per ton; the material (lime, etc.,) used in manufacture, about 6d.; and the cost of maintenance and repairs between the seasons should not exceed £2,500 to £3,000, or 1s. 3d. per ton; or in all, say, 17s. 1d. per ton, making the first cost of the sugar in the factory, if a ton be made from 7½ tons of cane, £6 8s. 1d. per ton. To this have to be added transport to port of shipment, which we can assume is covered by the value of the molasses; the cost of sacks, 5s. per ton; Insurance, say 4s.; and freight to the United States or the United Kingdom, say, 15s., making the cost of the sugar, f.o.s., New York or London, £7 12s. per ton.

There can be no doubt that refiners in either country would contract to buy the whole crop on analysis value, and at the price ruling on the day of delivery; and with trustworthy houses there would not be any need for agents or commissions, but allow for commission 2½ per cent. on the selling price, and this brings the cost up to, say, £8 per ton. The sugar should on an average be worth £14 per ton net, and on the crop of 6,000 tons there would thus be a profit of £36,000. The first charge on this should be interest on capital, £100,000 at 7 per cent., £7,000; then amortization, say, 4 per cent., £4,000; then there should be reserved, say, £2,000 for direction and sundry expenses; and of the balance, the salaried staff should get 10 per cent., leaving some £20,000 to be divided between the owners of the factory and the planters in, say, equal proportions: this would give both manufacturer and grower about 10 per cent. bonus on the capital invested, if it be allowed that the value of the plantations and the capital used in working them about equal the sum invested by those who built the factory.

Of course, the figures given represent the results of really good work, but precedent can be found in some part of the world for every assumption, even to the sale to refiners without agents; and it may from this statement be seen that if a suitable locality can be found for the venture, successful competition with the manufacturers of beet sugar is not impossible. There must, however, be a resolute brushing aside of traditional practice, and failure is certain unless those charged

with the control of the business are ready to profit by the experience of others—a condition not hitherto apparent to a great extent in the West Indies: indeed, one of the principal manufacturer's there recently stated that his firm had not yet adopted double crushing—a process that was an accomplished success in Demerara, at least, fifteen years ago, and has since been worked with a marked improvement in the returns in every quarter of the world.

AUSTRALIA.

We have received an advance proof of an article on Australia Sugar Production, which will appear in the *Year Book of Australia for 1891.** The article is well written and contains a mass of interesting information, but it is too long for insertion in full, though possibly we may find room for much of it in our next issue. For the present we must be content with the following statistical extracts:—

CONSUMPTION OF SUGAR PER HEAD.

Of the total quantity of sugar annually produced in New South Wales and Queensland, full 90 per cent. is consumed in Australia, the remaining 10 per cent. being exported to the United Kingdom, British New Guinea, and the South Sea Islands. But the quantity produced does not by any means satisfy our requirements; the bulk of the sugar consumed being imported from foreign countries, Mauritius furnishing the larger portion of the supply. According to Mr. Hayter, the Victorian Government Statistician, the average yearly consumption of sugar (both cane and beet) per head in Australia is higher than in Europe, as shown by the following tables:—

	Lbs.
South Australia	102·11
Western Australia	93·51
Victoria	90·75
Tasmania	90·49
Queensland	62·93
New South Wales	60·95
United Kingdom	68·99
Denmark	29·69
Holland	28·37
Switzerland	22·81
France	22·61
Sweden	17·22

In Belgium, Germany, Austria, Hungary, Norway, Finland, Portugal, Roumania, Russia, Spain, Servia, and Italy, the quantity

* To be had from Kegan Paul, Trench, Trübner & Co., Ltd., Ludgate Hill, London.

varies from 15·74 lbs. to 3·20 lbs. In New Zealand it is 118·77 lbs.; and in the Argentine Republic, 50·04 lbs. From the above figures it will be seen that the average annual consumption of sugar per head in Australia is 90¾ lbs., being 2 lbs. more per head than in the United Kingdom, in which the average is twice as high as in any country in continental Europe.

Imports of Sugar into Australia.

The details of the quantities of sugar imported into Australia during 1890 have not been published at the time of writing, but some idea of their extent and general character may be afforded by those recorded during the previous year, as follows:—

	Cwts.
Mauritius	431,132
Java, &c.	310,545
New Zealand	193,160
Hong Kong	132,686
Fiji	54,302
Natal	7,541
Singapore	5,750
India	5,000
China	4,051
United Kingdom	3,921
Brazil	80
Germany	74
United States	1
Total	1,148,243

RESULTS OBTAINED BY DIFFERENT METHODS OF WORKING IN A CANE SUGAR FACTORY.

By Geo. Stade (of Geo. Stade & Co.), Charlottenburg 2 (Berlin).

The data given in the three comparative statements (see below) are an extract from the record of a number of technical experiments made in several large sugar mills. It may be mentioned that it was not the original intention of the experimenter to show by the accompanying figures whether any one method of manufacturing sugar is or is not superior to another. The following tables can, however, be used for that purpose. How far this may possibly be practicable, everyone can judge for himself by comparing his particular process of sugar-making with the one sketched out here.

It is evident that in these times of sharp competition and various and frequently changing commercial arrangements, no sugar manu-

facturer, who is really a business man, can afford to select the process which may happen to find most favour in the eyes of the customer or refiner, as the case may be. The right way can, however, be indicated neither by the planter, chemist, engineer, nor merchant (as such), because only the practical and experienced manufacturer himself will be in a position to make such calculations as will embrace the entire field which has to be considered. In order not to misunderstand, we may add that the term manufacturer is used here only in the fullest sense, and, of course, it is open for everyone engaged in the trade to make use of these statements, whether occupied in planting, analysing, engineering, or merely acting in a trading capacity.

Possibly the resumé of the comparative specifications given below may not be entirely new to those familiar with the matter. Hitherto, however, no precise record of the kind has been published with regard to these different modes of working.

Operations.

The cane used during the whole period of the three trials had suffered severely from drought. The crop was characterised by small yield, short joints, and generally inferior quality. The manipulations in the manufacturing department were those usual in large works.

1. The canes were crushed in a three-roller mill of the strongest and best type, and

2. The juice strained once only.

3. The cold raw extract was sulphurated—in the case of B and C—in a counter-current sulphur-box of the simplest construction.

4. The raw juice brought up to boiling in a juice-heater was run off to the

5. Defecating boxes. Here the solution was defecated with lime; the liquor had to be kept neutral or slightly alkaline in the case of A—slightly acid in the case of B and C. It would be useless to give exact figures, as the quantities of sulphur burnt and lime added varied considerably.

6. The clear liquor was boiled and skimmed in the "Famous" clarifiers and

7. The scum filtered. The liquor from this went to the already clarified liquor.

8. The evaporation took place in a triple effect.

9. The syrup was drawn into the pans, without further filtration or clarification. In the case of B, chloride of tin was used, about 0·5 to 1·0 litres (1 to 2 pints) per ton of sugar.

10. The masse cuite No. I. was cured warm, no water at all being used.

11. The masse cuite No. II. was boiled down with addition of lime, and cured after standing about 14 days.

12. The masse cuite No. III. was left to crystallise until the end of the campaign.

The quality of the cane was much the same all round in the case of A and B. The sugar No. I., in the case of A, was made for refining purposes, dark grey in colour and small crystals.

The "Bloomer" sugar I., in the case of B was of an average quality, and the molasses sugar fair. The products in the case of C turned out much the same as A, but lighter in colour.

COMPARATIVE STATEMENTS RESPECTING:—

A. Non-chemical sugar.
B. Bloomer and sulphured sugar.
C. Sulphured sugar.

PRODUCT MADE	A. Non-Chemical Sugar.	B. Bloomer and Sulphurised Sugar.	C. Sulphurised Sugar.
NO. OF WEEK	1, 2, 3, 4, 5.	6, 7.	8, 9, 10, 11, 12, 13.
TIME OF GRINDING	Jan. 27th to Feb. 27th.	Feb. 28th to Mar. 13th.	Mar. 14th to April 24th.
CANES GROUND	Tons, 13,490.90	6,640.95	19,457.70
JUICE EXPRESSED	Galls, 1,834,380	931,260	2,716,590
Spec. Gravity	1·066	1·068	1·073
Balling	16·05	16·55	17·65
Polarization, lbs. per Gallon	1·437	1·501	1·613
Purity	84·16	84·96	86·29
Glucose, lbs. per Gallon	0·177	0·172	0·114
Glucose, per 100 Saccharose	12·33	11·46	7·06
INDICATED SACCHAROSE	Lbs., 2,636,043	1,397,514	4,382,201
do. .... do .... + Glucose 32%	2,739,942	1,448,771	4,448,802
CRUSHING, per cent.	64·71	66·86	66·88
SYRUP I.	Tons, 3,438	1,826	5,032
Per cent. Balling	44·0	38·0	44·0
Per cent. of Cane	25·5	27·5	25·8
MASSE CUITE I.	Tons, 1,480.60	798.88	2,458.79
Per cent. of Saccharose	78·07	79·00	79·07
Per cent. of Cane	10·98	12·03	12·64
SUGAR I.	Tons, 898.68	448.87	1,462.38
Per cent. of Saccharose	96·00	96·55	95·50
Per cent. of Cane	6·66	6·76	7·52
Per cent. of Masse Cuite I.	60·7	56·2	59·5
(a) Extraction (Raw) Sugar I. per cent. Indicated Saccharose	76·33	71·95	74·75
(b) Extraction, 32% of the Glucose added to the Indicated Saccharose	73·21	69·40	73·64
Gallons of Juice per Ton of Sugar I.	2041	2075	1858

	A.	B.	C.
PRODUCT MADE	Non-Chemical Sugar.	Bloomer and Sulphurised Sugar.	Sulphurised Sugar.
NO. OF WEEK	1, 2, 3, 4, 5.	6, 7.	8, 9, 10, 11, 12, 13.
TIME OF GRINDING	Jan. 27th to Feb. 27th.	Feb. 28th to Mar. 13th.	Mar. 14th to April 24th.
MASSE CUITE II.	Tons, 519.99	293.42	861.63
Per cent of Cane	3·86	4·42	4·43
Per cent. of Masse Cuite I.	35·1	36·7	35·0
SUGAR II	Tons, 191.06	87.80	258.75
Per cent. of Saccharose	83·72	82,85	82·53
Per cent. of Cane	1·42	1·31	1·33
Per cent. of Masse Cuite I.	12·9	11·0	10·5
Per cent. of Masse Cuite II.	36·7	29·9	30·0
SUGAR I. AND II.	Tons, 1,089.74	536.67	1,721.13
(a) Extraction (Raw) Sugar I. and II. per cent. of Indicated Saccharose	92·62	86·02	87·98
(b) Extraction, 32% of the Glucose added to the Indicated Saccharose	89·10	82·97	85·99
Gallons of Juice per Ton of Sugar I. and II.	1684	1735	1578
Per cent. of Cane	8·08	8·07	8·85
Per cent. of Masse Cuite I.	73·6	67·2	70·0
MASSE CUITE III.	Tons, 300.14	187.68	550.13
Per cent. of Cane	2·21	2·83	2·83
Per cent. of Masse Cuite I.	20·3	23·5	22·4
Per cent. of Masse Cuite III.	57·7	64·0	63·9
Time of Crystallisation	Days, 127	120	129
SUGAR III.	74·44	43·34	112·23
Per cent. of Saccharose	81·67	86·50	83·20
Per cent. of Cane	0·55	0·65	0·58
Per cent. of Masse Cuite I.	5·0	5·4	4·5
Per cent. of Masse Cuite III.	24·8	23·1	20·4
SUGAR I., II., AND III.	Tons, 1164.18	580.01	1833.36
(a) Extraction (Raw) Sugar I., II., and III. per cent. of Indicated Saccharose	98·93	92·97	93·72
(b) Extraction, 32% of the Glucose added to the Indicated Saccharose	95·17	89·69	91·64
Gallons of Juice per Ton of Sugar I., II., and III.	1576	1606	1482
Per cent. of Cane	8·629	8·734	9·422
Per cent. of Masse Cuite I.	78·63	73·52	74·56
Cane required for One Ton of Sugar	11·59	11·45	10·61
Tons of Sugar per Acre of Cane (average 16·94 Tons of Cane per Acre)	1·462	1·480	1·596
REST-MOLASSES	Tons, 225.70	144.34	437.90
Per cent. of Cane	1·673	2·174	2·251
Per cent. of Masse Cuite I.	15·24	18·07	17·81

The extraction figures for (*b*) are based upon the supposition that the sugar ($C_6H_{12}O_6$) in the cane is invert sugar, which means a mixture of 50% glucose and 50% lævulose (as it used to be called formerly). Since then the excellent researches of Mr. H. Winter have shown *positively* "that in mature and normal canes there exists no invert sugar, and that it is only the glucose ($C_{12}H_{12}O_6$) which here reduces the Fehling's solution, and practically nothing else." *Vide* "Mededeelingen van het Proefstation voor Suikerriet in West-Java," Deel. I., p. 31, et sqq.

For invert sugar, according to the data given Dr. E. O. von Lippmann, in his classic work,* "Die Zuckerarten und ihre Derivate," page 164, one part of invert sugar nullifies the rotation of:

0·34	parts	of saccharose—	according to	Meissl.
0·35	,,	,,	,,	Gayou.
0·32	,,	,,	,,	Von Lippmann.

As the latter figure is the result of analyses made with the purest invert sugar obtained by inversion of saccharose with carbonic acid, it is accepted here, but those extractions (*b*) are only given for comparison; because in colonial laboratories they are still in the habit, now and then, of adding this 32% of glucose to the polarisation. According to the above-mentioned investigations this is not correct as regards the analysis of normal canes, and should no longer be allowed. Even for clarified juice, syrup, and fresh made first product sugars, this method of adding to the polarisation on account of the invert sugar is not applicable, as in a well-managed and rationally constructed sugar-house no noteworthy conversion of saccharose should take place up to the first jet. Quite otherwise is it with the important question of deducting from the polarisation the ratio of optical declination caused by the glucose in the various substances, which would be well worthy of consideration, and it is to be hoped that this will be settled in a thorough and exhaustive manner at no distant date.

Further very interesting experiments made by other processes to obtain a first class refined sugar in form of granulated and cut-cubes are omitted at present, as they do not admit of being accurately

* Of which a revised and modernised edition, supplemented by complete tables (for laboratory also) is an absolute necessity. The publication of this would oblige the author and sugar-chemists all over the world, especially if he would have the kindness to make this indispensable book as practical as possible, without fearing to endanger by so doing the highly scientific character of his work.

compared with the above data. It may be sufficient to state that they show there can be no doubt that the manufacture of pure refined sugar in cane sugar factories is well worthy of being taken into consideration. In fact, it will turn out the proceeding of the future, in spite of political measures and other circumstances, which temporarily act as a check on its natural development in many sugar producing countries.

STRAITS SETTLEMENTS.

EXPORTS OF SUGAR FROM SINGAPORE IN 1889.

Piculs.		Value.
113,267	.. ..	$763,826

The greater portion went to Hongkong (41,700 piculs), and Siam (39,245 piculs), value together $554,077.

IMPORTS INTO SINGAPORE IN 1889.

Piculs.		Value.
212,513	.. ..	$1,372,540

The principal places from which this quantity came were Java (132,799 piculs), Penang (34,824 piculs), Hongkong (28,112 piculs), Cochin China (11,280 piculs), China (4,286 piculs.)

EXPORTS FROM PENANG IN 1889.

Piculs.		Value.
325,695	.. ..	$1,444,729

IMPORTS INTO PENANG IN 1889.

Piculs.		Value.
18,539	.. ..	$126,294

The exports to Hongkong were for refining purposes, as there are no refineries in Singapore.

The area under cultivation was in the province of Wellesley, 10,950 acres; in Penang, 420 acres; in the Island of Singapore and in Malacca the average was so small as to be unimportant.

HOME-GROWN SUGAR IN GREAT BRITAIN AND IRELAND.

In our April number last year we gave somewhat lengthy extracts from a paper with the above title, read before the Liverpool Society of Chemical Industry, by Dr. Gustav Schack-Sommer. On the 1st of last month another paper on the same subject was read by the same gentleman. This paper not having yet appeared in the Society's Journal, we are unable to give verbatim extracts, but we are glad to be in a position to supply such a summary as will put the main points before our readers. A reference to the former report will show that in 1889 Dr. Schack-Sommer conducted a series of experiments with beets grown on a farm in Ireland, and one near Liverpool, the results of which will be found in our report. Dr. Schack-Sommer has now continued these experiments on a larger number of farms, and the results which we are about to give in a tabular form seem to justify very fairly his contention that beets can be grown very profitably to the farmer. We know already that there is nothing to prevent sugar, equal to what is produced on the Continent, being made at a profit from the beet where a supply of the right kind of roots can be obtained. It would therefore really seem that nothing is now needed but to bring the farmer and the sugar manufacturer into *rapport*, or perhaps rather to create the manufacturer, and the one to do this is the capitalist. For it can hardly be expected, after the series of disastrous years which farmers in England have experienced, that many will be found who have spare capital to lay out on what is not a tolerable certainty, so that until the factory to work up the beets is actually ready, it may be assumed that the farmer will not grow the beets, nor will he be likely even to work on shares, as is done in so many cases on the Continent. That this is the case as regards the English farmer is shown by Dr. Schack-Sommer's own declaration in an article contributed to the journal of a local agricultural society. He says:—

"From all sides, with one exception, I have received the warmest encouragement to continue my experiments until they result in a practical issue. The one exception to which I allude you will admit is a somewhat remarkable one, for the farmers, who of all people in

the world, should have taken the greatest interest in these experiments, have, as a class, been indifferent or apathetic, happily with a few honourable exceptions. Generally speaking, however, they appear to have entirely failed to grasp the possibilities, nay even the certainties of profit opened up to them by this new branch of agricultural industry. They are content to go on in the old stereo-typed ways of their fathers as if the raising of a really profitable new crop was to them a matter of absolute indifference. This may be conservatism, or it may be distrust of anything in the nature of experiment, yet, what is certain is, that farmers on the Continent have every reason to be satisfied with a state of things which leaves them without British competition in a profitable industry, in the carrying on of which they are much more independent of the kind of weather they have in a season than in the case of ordinary agricultural operations. Under such circumstances it is not, I think, too much to assume that English farmers do not possess the enterprise of their continental rivals; and one surprising evidence of this is supplied by the fact that I have not had an enquiry for seed or for any further particulars from a single farmer in England, though leading articles on my experiments have appeared from time to time in nearly every newspaper in England, and the *Times*, the *Farmer's Magazine*, *Land and Water* and many others, gave very full extracts from my paper; and the Royal Agricultural Society in its Journal of 1st July, 1890, published a treatise which embodied all the experiments I had made up to that date, with the object of introducing into this country and into Ireland the cultivation of beetroot for sugar manufacture."

In Ireland Dr. Schack-Sommer met with a little better success, but in no case was there any great readiness shown by farmers to incur any outlay by contributing to the preliminary expenses of the experiments, even to the extent of paying carriage of a few roots for the purpose of analysis, as is evident from the following statement:—

"Before each date I had fixed for making a test, I sent letters to the farmers asking them for specimens of the beetroots grown from the seed I had furnished them with, but in the majority of cases I received no answer; and when I did, it was to the effect that if I, after supplying the seed gratuitously, would pay for the carriage of the roots to mine or Messrs. Newland Bros.' laboratory they would forward the required number. The proposal, in fact, was treated as

if it was one in which I alone had a pecuniary interest, and as if the last thing in the world to interest farmers was the creation of a new and profitable agricultural industry, even when others were disposed to go out of the way to take all the preliminary trouble off their hands beyond that of simply allowing the roots to grow on their farms. The British farmer, in fact, with agriculture at its lowest point of depression, did not seem to possess even that sort of gratitude which has been cynically defined by Rochefoucauld as a lively expectation of favours to come."

And, on the other hand, the manufacturer will not erect a factory and sink capital in plant which would be useless in any other branch of industry, until he is perfectly sure he will have a good and regular supply of proper beets, as the machinery is somewhat costly, and lies idle subject to expenses of maintenance, rent, &c., for a considerable portion of the year. It is quite evident that the thing wants some one to start it, for it is scarcely to be supposed that the failures of the past, which we believe can be fully explained, will deter clear-minded and experienced practical men from making further attempts. The situation somewhat reminds one of the sarcastic verse on the ill-fated Walcheren Expedition in 1809:

> The Earl of Chatham with his sword drawn
> Stood waiting for Sir Richard Strachan;
> Sir Richard, longing to be at 'em,
> Was waiting for the Earl of Chatham.

Looking at all the facts of the case, we should say the money ought to be forthcoming if it could be shown that raw beet sugar can be made as cheaply here as on the Continent, for it may be supposed, *cæteris paribus*, that refiners or merchants would as willingly buy home-made sugar as foreign. It has been said formerly, and with truth, that the bounties granted by foreign governments stand in the way, but the importance of this factor is very considerably lessened, now that the bounties have been so materially diminished. Perhaps those interested might derive some help from an article by the Editor of the French *Journal des Fabricants*, a translation of which will be found in the present number, on the cost of production of beet sugar in France and Germany.

Dr. Schack-Sommer points to the improved sugar-content of beets grown in Germany, the result of careful selection and cultivation

(see Table I.), and justly lays stress on the fact that beets grown in Ireland and near Liverpool, under ordinary circumstances, with no particular care or special knowledge, were actually richer in saccharine substance than those grown on the Continent.

TABLE I.

PERCENTAGE BY WEIGHT OF SUGAR IN GERMAN BEETROOT.

(From Official Records.)

Sugar Actually Extracted in Germany.

	Per cent.		Per cent.
1850-51	6·66	1879-80	8·52
1860-61	8·62	1880-81	8·79
1870-71	8·61	1881-82	9·56
1871-72	8·28	1882-83	9·51
1872-73	8·25	1883-84	10·54
1873-74	8·75	1884-85	10·79
1874-75	9·30	1885-86	11·43
1875-76	8·60	1886-87	11·87
1876-77	8·15	1887-88	13·08
1877-78	9·24	1888-89	11·96
1878-79	9·21		

Germany in this respect surpasses other countries, but from the smallness of the roots there are not so many tons produced per acre.

We quote again from the article by Dr. Schack-Sommer, already mentioned:—

"Before submitting the results of my experiments last year, I would remark that as regards any comparison with Mr. Licht's reports, his roots were ripe while mine were not. My roots were heavier though several degrees less in saccharine strength than Mr. Licht's. By the following table you will see that on the 9th October, 1890, Mr. Licht got 16·47 per cent. of saccharine strength, while I got only about 13·0 to 14·06 per cent.; and on the 24th October, the last day of testing, the roots contained only 15·02 per cent. The average weight in Mr. Licht's case was 842 grammes with leaves and 478 grammes without, while mine were upwards of 1,000 and even as high as 1795 grammes (about 3½ lbs.) with leaves, and without, 942 grammes (nearly 2 lbs. English)."

TABLE 2.

	F. O. LIGHT.	WAVERTREE. Grown at Dunbabin Farm by Mr. John Gibbons.				The Rathdown Union Workhouse, Loughlinstown, County Dublin, per Mr. John Conway.				Mr. R. P. Gray Spring Lodge, Athy County Kildare.	Mr. J. G. McNaught, Modreeny House, Clough-jordan, County Tipperary.	Mr. Jas. Kehoe, Morrtown Ballymitty, Wexford.	Mr. Ennis, Springwood, Ballymitty, Wexford.
Date of Experiment	Oct. 9, 1890.	October 9th.				October 9th.				Oct. 9th.	Oct. 9th.	Oct. 9th.	Oct. 9th.
		No. 1 SEED.	No. 2 SEED.	No. 3 SEED.	No. 4 SEED.	No. 1 SEED.	No. 2 SEED.	No. 3 SEED.	No. 4 SEED.	No. 1 SEED.	No. 4 SEED.		No. 1, 2, 3, & 4, SEEDS (mixed.)
Number of Beetroots drawn for experiments	106	10	10	10	10	10	10	10	10	11	10	10	10
Average weight with leaves in grammes	842	1268	969	1098	1061	1276	1502	1447	1261	1305	1364	1605	1334
Average weight without leaves in grammes	478	511	400	503	381	579	849	836	710	575	809	861	741
Largest root with leaves in grammes	1680	2900	1250	1400	1400	1900	2010	1980	1550	1730	1629	2700	1920
Largest root without leaves in grammes	1150	1170	560	650	600	790	1290	1250	1090	770	920	1480	1000
Smallest root with leaves in grammes	450	800	730	550	700	850	930	1060	840	830	1080	740	350
Smallest root without leaves in grammes	200	300	300	270	230	330	550	430	370	340	630	410	180
Specific Gravity of Juice	1·0811	1·0668	1·0639	1·0617	1·0649	1·0654	1·0561	1·0582	1·06508	1·0648	1·0593	1·0547	1·05892
Degrees by Brix Saccharometer	19·5	16·2	15·5	15·	15·9	16·	13·8	14·3	15·9	16·	14·5	13·5	14·5
Quantity of Sugar in 100 parts	16·47	13·	13·3	12·8	13·7	13·	10·	11·2	12·2	13·	11·9	10·2	11·4
Quantity of non-Sugar in 100 parts.............	3·03	3·2	2·2	2·	2·2	3·	3·8	3·1	3·7	3·	2·9	3·3	3·1
Quotient of Purity......	84·5	80·3	85·8	85·3	86·2	81·3	72·5	78·3	76·3	81·3	82·1	75·6	78·6
		Rich Clay Loam on Red Sandstone.				Clay Loam, Yellow Clay Subsoil,				Light Loam Soil.	Clayey Loam, Limestone Concrete, Subsoil.	Loose Marshy Soil.	Reddish Shingley Soil.

TABLE 2.—*Continued.*

	Mr. W. Byrne, Ballyknock, Wexford.	Miss Richards, Ballymitty, Wexford.	Mr. W. Smith, Dodsboro', Lucan, Co. Dublin.	Mr. Francis Keane, Lesternan Farm, County Mayo.	Mr. J. Jack, Steward, Pakenham Hall, Castle Pollard, Co. Westmeath.	Mr. Mark White, Castletown, Wexford.	Mr. John Gibbons, Dunbabin Farm, Wavertree.				Mr. T. Grant, Ballytergue Castle, Kilmore Quay Co. Wexford.	Mr. Thompson Arkman, jun., Glasgow.		
Date of Experiment ..	Oct. 9th.	Oct. 9th.	Oct. 9.	Oct. 9.	Oct. 9.	Oct. 9.	October 24th.				Received Nov. 9th.			
			No. 3 SEED.		No. 2 SEED.		No. 1 SEED.	No. 2 SEED.	No. 3 SEED.	No. 4 SEED.				
Number of Beetroots drawn for experiments	10	10	12	10	10	10	10	10	11	10	4	4	2	2
Average weight with leaves in grammes ..	1349	1795	333	..	1960	2130	985	790	704	785	1155	..	..	..
Average weight without leaves in grammes ..	718	942	158	432	878	1005	437	386	385	421	838	483	425	310
Largest root with leaves in grammes	2150	2300	530	..	2600	4020	1250	1140	1490	1200	1410	..	..	..
Largest root without leaves in grammes ..	1350	1380	310	700	1550	1710	590	560	900	740	1030	690	610	466
Smallest root with leaves in grammes ..	450	1400	210	..	1280	920	700	580	490	540	1000	..	..	..
Smallest root without leaves in grammes ..	180	590	90	320	520	390	330	240	290	320	714	425	240	160
Specific Gravity of Juice	1·07064	1·0648	1·0613	1·0627	1·0501	1·0652	1·0757	1·0678	1·0664	1·0658	1·0745	..	..	..
Degrees by Brix Saccharometer	17·2	15·9	15·1	15·3	12·4	15·8	18·2	16·3	16·2	16·	18·02	14·	..	..
Quantity of Sugar in 100 parts............	14·6	13·2	12·4	12·8	8·2	12·3	15·2	14·	13·9	13·6	14·64	11·2	11·7	13·3
Quantity of non-Sugar in 100 parts.........	2·6	2·7	2·7	3·5	4·2	3·5	3·	2·3	2·3	2·4	3·38	2·8	..	..
Quotient of Purity	84·9	83·	82·1	83·7	66·1	77·8	83·5	85·9	85·9	85·	81·24	8·0	..	..
	Deep free Soil.		Rich Soil.	Peaty Gravelly Soil.	Newly Reclaimed Moor or Waste Land 4 years ago.	Medium rather Light. Soil.	Rich Clay Loam on Red Sandstone.				Analysed by Newlands Bros.			

Dr. Schack-Sommer remarks that the saccharine strength of the beets grown in 1890 was lower than that of those grown in 1889, and accounts for this by the dampness and coldness of the season, and the fact of the roots not being fully ripe when tested. He says the point now to be determined is which kind of root will ripen earliest, and this is a question of the selection of seed. The great development of the sugar industry on the Continent has been greatly assisted by the agricultural chemist, who has managed to raise the saccharine strength (sugar-content) of the beetroot to that of the best sugar cane. We now quote at length from the article already mentioned:—

"As evidence of what has been done in France in the way of developing this cultivation, pray note the fact, that while in 1881-2 the yield of sugar per hectare, a little over two acres, was 1 ton $14\frac{1}{5}$ cwts., in 1885-6 it had risen to 2 tons $6\frac{1}{5}$ cwts., and 1889-90 to 3 tons $1\frac{9}{10}$ cwts., an actual doubling of the production in the short space of ten years. Pray note, too, that not only has there been an enormous increase in the saccharine strength of the French beetroot, but that this has been accompanied by great improvements in the machinery and manipulative processes of manufacture. For instance, in France, in 1881-2, to manufacture 1 ton of sugar they used 17 tons $3\frac{4}{10}$ cwts. of beetroot; in 1885-6, 11 tons $8\frac{4}{10}$ cwts.; and in 1889-90, 8 tons $11\frac{1}{5}$ cwts. I will give you the figures for each year, so that you may more clearly appreciate the rate of progress:—

	Average quantity of Sugar produced per hectare (a little over 2 acres).		Average quantity of Beetroot used to make 1 ton of Sugar.	
	Tons.	Cwts.	Tons.	Cwts.
1881-2	1	$14\frac{1}{5}$	17	$3\frac{4}{10}$
1882-3	1	$15\frac{1}{10}$	17	$17\frac{8}{10}$
1883-4	1	$19\frac{7}{25}$	16	5
1884-5	1	$17\frac{1}{2}$	15	$0\frac{4}{10}$
1885-6	2	$6\frac{1}{5}$	11	$8\frac{4}{10}$
1886-7	2	$16\frac{1}{2}$	10	3
1887-8	2	3	9	$8\frac{8}{10}$
1888-9	2	$7\frac{1}{5}$	9	$4\frac{2}{10}$
1889-90	3	$1\frac{9}{10}$	8	$11\frac{2}{10}$

"These figures I have taken from the official returns published by the French Government.

"I will now endeavour to explain what has been done on the Continent in order to secure these amazing results. In doing this I need not go back to the original Silesian beetroot and those which are

to-day only of historic interest, but will direct your attention to the well-known contemporary experts in beetroot cultivation, Messrs. Rathbethge & Giesecke, in Klein Wanzleben, near Madgeburg, and Messrs. Vilmorin-Andriens & Co., of Paris. Before proceeding further, I may, at this point, insert part of a letter which I have received from the latter firm on the subject of the selection of seed:—'We have read with great interest your pamphlet on the introduction of the sugar industry into the British Isles, and we are of opinion that it may be successful, as no climatic or economic conditions stand in the way of its development. Although the German beet seeds are of very good quality and widely used even in this country, we think that it is worth the while to experiment with the French strains, of which we should advise *three*, as follows:—

"1. *Blanche Ameliorée Vilmorin.*

"2. *Rose Trâtive* (early Red-skinned Sugar Beet).—This is inferior to the former variety in the proportion of sugar it contains, and is remarkable in being the earliest of all known sugar beets. The leaves becomes quite flat on the ground sooner than in most kinds, and the roots are ready for taking up about the middle of September.

"*Française à Collet Rose* (Red Top Sugar Beet).—This last variety is nearly equal to Rose Trative in point of earliness, and the yield per acre would be a good deal heavier. The proportion of sugar would be about 25 per cent. below that of Améliorée Vilmorin, but the weight of roots per acre might be above the latter by one-third, or even more. Now it is an important point to secure the co-operation of the farmers, and it might be no bad policy to try experiments with variety that would give them a fair return in weight. The roots would be paid for more or less according to their industrial value, but we think the money return to the farmer would be rather higher with *a large crop of roots of medium quality* than with *a fair crop of very rich beets.*

"As no tax is put upon sugar in the United Kingdom, all the artificial conditions established on the Continent by the mode of levying the taxes, and the premiums which result therefrom, are unknown, and the variety can be chosen that gives best satisfaction to both grower and manufacturer.'

"In 1889 the roots grown from the Klein Wanzleben seed succeeded best in my experiments, and this determined me to investigate on the spot the whole process of rearing the seed. Under the German

fiscal system it has been to the advantage of the sugar manufacturer to grow a root as rich as possible in saccharine strength, and this led them to grow very small roots. The Klein Wanzleben people, however, were by no means satisfied with this arrangement, for, knowing that the farmer is paid by weight, he would obviously be a loser by only growing small rich roots. They therefore took the sensible course in directing their energies towards the raising of a root that surpassed all others in the percentage of sugar PER ACRE, thus meeting the demands of both the farmers and the manufacturers.

"Messrs. Rabbethge and Giesecke state that they have been raising beetroot seed for thirty years, and that their plan is to select the mother seed beetroots by special methods from different families. In 1889-90, for instance, they tested 2,782,300 beetroots, from which they selected 3,043 roots, or equal to 0·1 per cent. for seed-growing purposes. It is claimed for the original Klein Wanzleben roots that they give the largest percentage of sugar per acre. I will give here the table published, and furnished to me by Messrs. Otto Licht and Co., of the experiments of Professor Dr. Maercker in Emersleben, near Halberstadt, showing the comparative results of different kinds of seed for sugar beetroot.

"Messrs. Otto Licht & Co. published figures in 1866 showing the results of experiments made by Professor Dr. Maercker in Emersleben, near Halberstadt, showing strikingly the importance of the proper choice of seed.

Name.	Crop of Sugar Beetroot per Acre.		Sugar in the Beetroot.
	Tons.	Cwts.	Per cent.
Vilmorin Original	11	5	16·3
Heine do.	13	2	17·0
Dippe do.	10	12	17·3
Schreiber do.	10	6	16·0
Wanzleben Original	15	0	15·2
Heine do.	16	2	16·0
Dippe do.	14	2	16·3
Schreiber do.	15	12	14·0

"His elaborate calculations, which take into account all costs, including the manufacture and farming, &c., show a net profit per acre for that year ranging from £6 12s. to £15 7s., or a difference of £8 15s. In Germany that year 275,000 hectars, equal to 687,500

acres were planted with sugar beetroot. It is not amazing that even among these high-class seeds the monetary-difference for that empire between the highest and the lowest should have amounted to £6,000,000, or for each factory, on a rough average, £15,000?

"Another report by the same gentleman has been used by Messrs. Rabbethge and Giesecke in compiling a circular which they have sent me, and where they show without doubt that all the sugar beetroots descending from the Klein Wanzleben root compare very favourably indeed with those descending from the roots of Mr. Vilmorin's rearing.

	A. Sugar Beetroot descending from the Vilmorin variety.				B. Sugar Beetroot descending from the Klein Wanzleben variety.			
	Ctrs.		Tons.	Cwts.	Ctrs.		Tons.	Cwts.
Beetroot per acre	242·37	equal	12	2	301·62	equal	15	2
Sugar	38·47	,,	1	18	45·45	,,	2	5
Quantity of Sugar in 100 parts of Beetroot.	15·80%				15·06%			

"After what has been said of the Klein Wanzleben roots and its descendants, you will perhaps be surprised to hear that I am not at all sure that it is really the most suitable one for our English or the Irish climate, because it takes a rather longer time to get ripe than (for instance) the Vilmorin root which has been raised in a cold soil and off cuttings. The difference in the time of ripening between the two is about six weeks.

"Lime, phosphoric acid, and nitrate are very useful and essential manures for the beetroot, but they must neither be applied in too large quantities nor at the wrong time.

"Some friends of mine, who are great authorities in this question, wrote to me last year after the publication of my paper, that they thought I had recommended a too great proportion of phosphoric acid, and that one of phosphoric acid to one of nitrate would be nearer the mark; whereas I say in my former paper, a very good artificial manure for beetroot is one containing one part of nitrogen to two parts of phosphoric acid as super-phosphate. The proper proportion is about 160 lbs. nitrate and 320 lbs. super-phosphates, or 320 lbs. Peruvian guano and 160 lbs. super-phosphate per acre. In Germany they spend as much as £2 to £3 per acre for artificial manure. Both in Lancashire and County Wexford, where there had been no special preparation of the soil, and the plants had not been

thinned as they grew up, and in spite of the fact that the latter part of the season had been cold and wet, the yield then from the roots compared most favourably with the best grown in Germany.

"The soil, the proper preparation of it by ploughing, and the manure are all important points in the growing of sugar beetroot. The soil should be a loam containing lime, with a well-drained bottom, or one that drains itself well; very wet or swampy ground being quite unsuited for the purpose. In mountainous districts the summer is too short; the beetroot does not ripen, and contains too little sugar to make its cultivation profitable. The soil has to be ploughed up very deeply—the deeper the better—unless the subsoil is unsuitable.

"With regard to the probable profit of beetroot-growing in this country, I have prepared the following table, showing the cost of planting and working, including delivery at the works; and in doing this I have taken English measures and weights, which have been checked and found approximately correct by English farmers. (See Table 3).

TABLE 3.

AMOUNT REALISED.

	£	s.	d.
The result per acre:—			
33,070 lbs. (nearly 15 tons) beetroot, at 1s. 1d. per cwt.	15	19	10
35 per cent. residue (over 5 tons) for feeding cattle = 11,574 lbs. at 3½d. per cwt.	1	10	2
8,250 lbs. leaves and roots (nearly 4 tons), at 3d. per cwt... ..	0	18	6
	£18	8	6

COST OF GROWING.

	£	s.	d.
Topping stubble	0	6	0
Twice harrowing	0	3	0
Deep ploughing with four horses or steam	1	2	0
Twice harrowing in Spring	0	2	0
Artificial manure	2	10	0
Drilling, harrowing, drilling and rolling	0	12	0
Hoeing and weeding	0	2	0
Beetroot seed	0	10	6
Horse-hoed or drilled three times	0	6	0
Hoed by hand twice	0	9	0
Thinning	0	5	0
Banking the roots	1	0	0
Sending roots to works	1	16	0
To make the silos..	0	1	6
Rent, tithe, taxes, and other charges	3	8	0
	£12	13	0

	£	s.	d.
Amount realised per acre	18	8	6
Expense of working (or all and every expense incurred)	12	13	0
Net profit per acre	£5	15	6

Mr. John Algernon Clarke's Table.

	£	s.	d.
Rent, tithe, taxes and other common charges..	3	0	0
Clearing and forking wheat stubble..	0	1	6
Carting 10 loads farmyard manure, 5s. 6d.; spreading, 1s. 6d. ..	0	7	0
Ploughing 10in. deep and sub-soiling 6in. more	1	2	0
Cultivating in Spring, 2s. 6d.; harrowing and rolling, 5s... ..	0	7	6
7 cwt. superphosphate, £2 2s.; preparing and sowing, 3s.	2	5	0
Seed (12 lbs.)..	0	7	6
Drilling and crushing or rolling	0	2	0
Hoeing and singling	0	15	0
Taking up, topping, and putting in heaps	0	16	0
Carting, graving, and earthing down	0	14	0
	£9	17	6
To this he adds delivery to factory 20 tons 2½ miles at 6d. per ton per mile for haulage, and 3d. per ton for working	1	10	0
	£11	7	6
Add supposed value of 10 loads fresh farmyard manure (say 4s.)..	2	0	0
Total without interest	£13	7	6

IMPROVED CRUSHING MACHINERY.

A new crushing plant has just been patented, under the name of "The Cycle Mill." This mill has been designed with the object of supplying a long-felt want, that of obtaining from the cane a greater percentage of juice without necessitating the discarding of existing mills or plant. This, we are informed, is effected by passing the cane in a cycle between six or more rolls, one of which is a central driving roll; a mill with six rolls subjects the canes six times to pressure during their passage through it. A special feature is, that an existing mill of the three roll type can be converted into a "Cycle" mill (irrespective of the construction of the side frame) without any structural alteration, or any disturbance of the foundations or gearing or of the steam engine. This is said to enable the planter or sugar manufacturer to obtain, with a small outlay, a better extraction with a single mill than is obtained by double or treble crushing plants. We hope to be able to give a more detailed description next month.

UNITED STATES.

REPORT OF WORKING OF THE CAFFERY CENTRAL REFINERY, FRANKLIN (LOUISIANA).

(Continued from page 202.)

FIRST SUGAR.

The first four weeks of the season, yellow clarified sugars were made, with an average polarization of 98·9 per cent. The yield was then from 120 to 130lbs. per ton. Later we abandoned making fancy sugars and used only one syringe of water in the centrifugal, in order to free the sugar from sieve. The yield on first sugar then came up to 150lbs. Taking into consideration the per cent. of sucrose in cane, and the extraction, the increase of the yield on first sugar was 12lbs. per ton in favour of not washing. The difference in the market price only ⅛ of a cent. A simple calculation shows where the advantage lies. Suppose washed sugar yields 120lbs. per ton at 5 cents, and unwashed sugar 132 at 4⅞ cents; difference in favour of not washing, 43½ cents per ton. It is wrong in supposing that all loss in the washed sugar is obtained in the second product.

Sugar loses mechanically as well as by inversion between first and second product. The more sugar there is taken over from first to second product, the more will be lost in proportion; besides this, it must be remembered that the sugar washed away in the centrifugal goes into a product much poorer than the first masse cuite, and its re-crystallization never will be complete, as it was in the first place. The principle in sugar making must be to make as much sugar as possible in the first place. It never will do for raw sugar houses to compete with the refineries as long as the market does not pay for the sacrifices.

SECOND AND THIRD MASSE CUITE.

The molasses coming from the first as well as from the second sugars passed through a Villavaso Molasses Mixer, wherein it was reduced to 30 degrees Baumé and thoroughly mixed. The Villavaso has the great advantage over the blow-up in dissolving all the fine grain without any danger of burning the molasses. From the mixer the molasses was pumped to receiving tank and after having collected a sufficient quantity were immediately taken into the vacuum pan.

The second masse cuite was dropped into cars containing 2,300lbs., and after standing 14 days in the hot room they were purged. All the thirds have been stored in large tanks and will be purged in May or June. Some of the thirds have already been purged, from which we have estimated the average yield.

Analysis.

	2nd Masse Cuite. Per cent.	3rd Masse Cuite. Per cent.
Solids	90·82	91·95
Sucrose	56·44	43·60
Purity	62·14	47·41

Filter Presses.

The skums and settlings from the clarifiers, and the settlings and washing of the syrup tanks were filtered, but owing to inadequate filtering capacity some loss was occasioned.

Consumption of Coal.

The coal boilers, as well as the bagasse boilers, were provided with meters to register the amount of feed water. The amount of water evaporated per lb. of coal in coal boilers was 7½lbs., and in bagasse boilers 2½lbs. coal per lb. of bagasse, on an average steam pressure of 75lbs. The total coal consumption was 5,879,000lbs.

Results, Season 1890-91.

Cane ground, tons, 32,180; lbs., 64,360,000.
  Sucrose, per cent. of cane, 12·01.
  Sucrose, per ton of cane, lbs., 240·2.
Total sucrose in cane ground, 7,729,636 lbs.
  Fiber, per cent. of cane, 11·02.
  Juice, per cent. of cane, 88·98.
Juice extracted, gallons, 5,433,881; lbs., 48,361,540.
  Juice extracted, per cent. of cane, 75·14.
  Per cent. sucrose in raw juice, 13·50.
Total sugar extracted, 6,528,308.
  Sucrose extracted, per cent. of cane, 10·14.
  Sucrose extracted, per ton of cane, 202·8 lbs.
  Sucrose extracted, per cent. of sucrose in cane, 84·46.
Bagasse obtained, 7,999 tons; 15,998,460 lbs.
  Bagasse, per cent. of cane, 24·86.

Juice lost in bagasse, 8,906,128 lbs.

Juice lost in bagasse, per cent. of cane, 13·83.

Sugar lost in bagasse, 1,202,327 lbs.

Sugar lost in bagasse, per cent. of cane, 1·86.

Syrup obtained, 1,617,686 gallons, 16,403,368 lbs.

Per cent. sucrose in syrup, 39·00.

Total sucrose in syrup, 6,397,313 lbs.

Loss of sucrose between raw juice and syrup, 131,495 lbs.

Press cakes obtained, 624,000 lbs.

Per cent. sucrose in press cakes, 7·60.

Sugar lost in press cakes, 47,424 lbs.

Lost by inversion between juice and syrup, 44,150 lbs.

Mechanical loss of sugar between raw juice and syrup (Entrainment in triple effect, &c.), 39,921 lbs.

First masse cuite obtained, 8,238,678 lbs.

Per cent. sucrose in first masse cuite, 77·0.

Total sucrose in first masse cuite, 6,343,782 lbs.

Loss of sucrose by inversion between syrup and first masse cuite, 42,193 lbs.

Total loss by inversion between juice and first masse cuite, 86,943 lbs.

Total mechanical loss (not accounted for) between juice and first masse cuite, 50,659 lbs.

Total loss between raw juice and first masse cuite, 185,026 lbs.

Total loss per cent. of sucrose extracted, 2·83.

First sugar obtained, 4,488,800 lbs.

Polarization of first sugar, 97·59.

First sugar obtained per ton of cane, 139·49 lbs.

Second masse cuite obtained, 3,440,000 lbs.

Per cent. sucrose in second masse cuite, 56·44.

Total sucrose in second masse cuite, 1,941,536 lbs.

Loss of sucrose between first and second masse cuite, 21,626 lbs.

Second sugar, 1,204,000 lbs.

Polarization of second sugar, 93·30.

Second sugar per ton of cane, 37·41 lbs.

Third masse cuite obtained, 1,850,000 lbs.

Per cent. sucrose in third masse cuite, 43·6.

Total sucrose in third masse cuite, 806,600 lbs.

Sugar lost between second and third masse cuite, 11,604 lbs.

Third sugar estimated, 450,000 lbs.

Third sugar per ton of cane, 13·98 lbs.

Total commercial sugar made and estimated, 6,142,800 lbs.

Total commercial sugar per ton of cane, 190·88 lbs.

Sugar made from outside syrups, 650,000 lbs.

Total sugar made, 6,792,800 lbs.

Results.

	Per cent. of Cane.
First sugar of 100 polarization	6·80
Second sugar of 100 polarization	1·74
Sugar in third masse cuite	1·25
Sugar lost in bagasse	1·86
Mechanical loss and by inversion	0·34
Loss not accounted for	0·02
Sugar, per cent. of cane	12·01

UNITED STATES.

Laws in Regard to Sugar.

[Act of October 1, 1890, 26 Stat., 567.]

An Act to reduce the revenue and equalize duties on imports, and for other purposes.

Section 1.

Bounty on Sugar.

231. That on and after July first, eighteen hundred and ninety-one, and until July first, nineteen hundred and five, there shall be paid, from any moneys in the Treasury not otherwise appropriated, under the provisions of section three thousand six hundred and eighty-nine of the Revised Statutes, to the producer of sugar testing not less than ninety degrees by the polariscope, from beets, sorghum, or sugar-cane grown within the United States, or from maple sap produced within the United States, a bounty of two cents per pound; and upon such sugar testing less than ninety degrees by the polariscope, and not less than eighty degrees, a bounty of one hundred and three-fourths cents per pound, under such rules and regulations as the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall prescribe.

Notices, Applications for License, and Bonds.

232. The producer of said sugar to be entitled to said bounty shall have first filed prior to July first of each year with the Commissioner of Internal Revenue a notice of the place of production, with a general description of the machinery and methods to be employed by him, with an estimate of the amount of sugar proposed to be produced in the current or next ensuing year, including the number of maple trees to be tapped, and an application for a license to so produce, to be accompanied by a bond in a penalty, and with sureties to be approved by the Commissioner of Internal Revenue, conditioned that he will faithfully observe all rules and regulations that shall be prescribed for such manufacture and production of sugar.

Licenses.

233. The Commissioner of Internal Revenue, upon receiving the application and bond hereinbefore provided for, shall issue to the applicant a license to produce sugar from sorghum, beets, or sugar-cane grown within the United States, or from maple sap produced within the United States at the place and with the machinery and by the methods described in the application; but said license shall not extend beyond one year from the date thereof.

No Bounty to be paid in certain cases. Regulations and Inspection.

234. No bounty shall be paid to any person engaged in refining sugars which have been imported into the United States, or produced in the United States upon which the bounty herein provided for has already been paid or applied for, nor to any person unless he shall have first been licensed as herein provided, and only upon sugar produced by such person from sorghum, beets, or sugar-cane grown within the United States, or from maple sap produced within the United States. The Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall from time to time make all needful rules and regulations for the manufacture of sugar from sorghum, beets, or sugar-cane grown within the United States, or from maple sap produced within the United States, and shall, under the direction of the Secretary of the Treasury, exercise, supervision and inspection of the manufacture thereof.

Payment of Bounties.

No Bounty upon less than five hundred pounds.

235. And for the payment of these bounties the Secretary of the Treasury is authorized to draw warrants on the Treasurer of the

United States for such sums as shall be necessary, which sums shall be certified to him by the Commissioner of Internal Revenue, by whom the bounties shall be disbursed, and no bounty shall be allowed or paid to any person licensed as aforesaid in any one year upon any quantity of sugar less than five hundred pounds.

Penalties.

236. That any person who shall knowingly refine or aid in the refining of sugar imported into the United States or upon which the bounty herein provided for has already been paid or applied for, at the place described in the license issued by the Commissioner of Internal Revenue, and any person not entitled to the bounty herein provided for, who shall apply for or receivè the same, shall be guilty of a misdemeanor, and upon conviction thereof, shall pay a fine not exceeding five thousand dollars, or be imprisoned for a period not exceeding five years, or both, in the discretion of the court.

Import Duties. Beet-Sugar Machinery free until July 1, 1892.

237. All sugars above number sixteen Dutch standard in colour shall pay a duty of five-tenths of one cent per pound: *Provided*, That all such sugars above number sixteen Dutch standard in colour shall pay one-tenth of one cent per pound in addition to the rate herein provided for, when exported from, or the product of any country, when and so long as such country pays or shall hereafter pay, directly or indirectly, a bounty on the exportation of any sugar that may be included in this grade which is greater than is paid on raw sugars of a lower saccharine strength; and the Secretary of the Treasury shall prescribe suitable rules and regulations to carry this provision into effect:

And provided further, That all machinery purchased abroad and erected in a beet-sugar factory and used in the production of raw sugar in the United States from beets produced therein shall be admitted duty free until the first day of July, eighteen hundred and ninety-two: *Provided*, That any duty collected on any of the above-described machinery purchased abroad and imported into the United States for the uses above indicated since January first, eighteen hundred and ninety, shall be refunded.

238. Sugar candy and all confectionery, including chocolate confectionery, made wholly or in part of sugar, valued at twelve cents or less per pound, and on sugars after being refined, when tinctured, coloured, or in any way adulterated, five cents per pound.

239. All other confectionery, inluding chocolate confectionery, not specially provided for in this Act, fifty per centum *ad valorem*.

240. Glucose, or grape sugar, three-fourths of one cent per pound.

Provisions take effect April 1st, 1891.

241. That the provisions of this Act providing terms for the admission of imported sugars and molasses and for the payment of a bounty on sugars of domestic production shall take effect on the first day of April, eighteen hundred and ninety-one:

Provided, That on and after the first day of March, eighteen hundred and ninety-one, and prior to the first day of April, eighteen hundred and ninety-one, sugars not exceeding number sixteen Dutch standard in colour may be refined in bond without payment of duty, and such refined sugars may be transported in bond and stored in bonded warehouse at such points of destination as are provided in existing laws relating to the immediate transportation of dutiable goods in bond, under such rules and regulations as shall be prescribed by the Secretary of the Treasury.

Section 2.

Free List.

726. Sugars, all not above number sixteen Dutch standard in colour, all tank bottoms, all sugar drainings and sugar sweepings, syrups of cane juice, melada, concentrated melada, and concrete and concentrated molasses, and molasses.

Conditional Duty on Sugar.

Section 3. That with a view to secure reciprocal trade with countries producing the following articles, and for this purpose, on and after the first day of January, eighteen hundred and ninety-two, whenever, and so often as the President shall be satisfied that the Government of any country producing and exporting sugars, molasses, coffee, tea, and hides, raw and uncured, or any of such articles, imposes duties or other exactions upon the agricultural or other products of the United States, which in view of the free introduction of such sugar, molasses, coffee, tea, and hides, into the United States, he may deem to be reciprocally unequal and unreasonable, he shall have the power and it shall be his duty to suspend, by proclamation to that effect, the provisions of this Act relating to the free introduction of such sugar, molasses, coffee, tea, and hides, the production of such country, for such time as he shall deem just, and in such

case and during such suspension, duties shall be levied, collected, and paid upon sugar, molasses, coffee, tea, and hides, the product of or exported from such designated country as follows, namely:

All sugars not above number thirteen Dutch standard in colour shall pay duty on their polariscopic tests as follows, namely:

All sugars not above number thirteen Dutch standard in colour, all tank bottoms, syrups of cane juice or of beet juice, melada, concentrated melada, concrete and concentrated molasses, testing by the polariscope not above seventy-five degrees, seven-tenths of one cent per pound; and for every additional degree or fraction of a degree shown by the polariscopic test, two hundredths of one cent per pound additional.

All sugars above number thirteen Dutch standard in colour shall be classified by the Dutch standard of colour, and pay duty as follows, namely: All sugar above number thirteen and not above number sixteen Dutch standard of colour, one and three-eighths cents per pound.

All sugar above number sixteen and not above number twenty Dutch standard of colour, one and five-eighths cents per pound.

All sugars above number twenty Dutch standard of colour, two cents per pound.

Molasses testing above fifty-six degrees, four cents per gallon.

Sugar drainings and sugar sweepings shall be subject to duty either as molasses or sugar, as the case may be, according to polariscopic test.

Alcohol free of Tax for making Sugar from Sorghum.

(Extract from Act approved March 3rd, 1891, making appropriations for the Department of Agriculture for the fiscal year ending June 30th, 1892.)

That any manufacturer of sugar from sorghum may remove from distillery warehouses to factories used solely for the manufacture of such sugar from sorghum, distilled spirits in bond free of tax, to be used solely in such manufacture of sugar from sorghum; that all distilled spirits removed as herein authorized shall be of an alcoholic strength of not less than one hundred and sixty per centum proof, and may be removed, stored, and used in the manufacture of sugar from sorghum, and when so used may be recovered by redistillation

in the sugar factory of such sugar manufacturer under such bonds, rules, and regulations, for the protection of the revenue and the accomplishment of the purposes herein expressed as the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, may prescribe.

Any person who removes or uses distilled spirits in violation of this provision, or the regulations issued pursuant thereof, shall, on conviction thereof, be fined not less than one thousand dollars nor more than five thousand dollars for each offence, and the spirits and the premises on which such spirits are used shall be forfeited to the United States.

BOUNTY ON SUGAR.

Regulations relative to the Bounty on Sugar of domestic production under the provisions of the Act entitled "An Act to reduce the Revenue and equalize Duties on Imports and for other purposes," approved, October 1, 1890.

Treasury Department, Office of Internal Revenue,
Washington, D. C., March 7, 1891.

The Act of Congress approved October 1, 1890, entitled "An Act to reduce the revenue and equalize duties on imports and for other purposes," (Schedule E) provides

(231) "That on and after July first, eighteen hundred and ninety-one, and until July first, nineteen hundred and five, there shall be paid, from any moneys in the Treasury not otherwise appropriated, under the provisions of section three thousand six hundred and eighty-nine of the Revised Statutes, to the producer of sugar testing not less than ninety degrees by the polariscope, from beets, sorghum, or sugar-cane grown within the United States, or from maple sap produced within the United States, a bounty of two cents per pound; and upon such sugar testing less than ninety degrees by the polariscope, and not less than eighty degrees, a bounty of one and three-fourths cents per pound, under such rules and regulations as the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall prescribe."

It further provides that

(232) "The producer of said sugar to be entitled to said bounty shall have first filed prior to July first of each year with the Com-

missioner of Internal Revenue a notice of the place of production, with a general description of the machinery and methods to be employed by him, with an estimate of the amount of sugar proposed to be produced in the current or next ensuing year, including the number of maple trees to be tapped, and an application for a license to so produce, to be accompanied by a bond in a penalty, and with sureties to be approved by the Commissioner of Internal Revenue, conditioned that he will faithfully observe all rules and regulations that shall be prescribed for such manufacture and production of sugar."

It further provides that

(233) "The Commissioner of Internal Revenue, upon receiving the application and bond hereinbefore provided for, shall issue to the applicant a license to produce sugar from sorghum, beets, or sugar-cane grown within the United States, or from maple sap produced within the United States at the place and with the machinery and by the methods described in the application; but said license shall not extend beyond one year from the date thereof."

When the Act takes effect.

The Act states that the provisions thereof providing terms for the payment of the bounty shall take effect on the first day of April, 1891.

By this expression it is understood that April first is the date fixed when applications for licenses may be made and the notices and bonds filed, and the law becomes operative so far as authorizing the issuing of licenses by the Commissioner of Internal Revenue, but it was not intended that bounties should be paid on sugar produced prior to July 1, 1891.

The words "current or next ensuing year" in paragraph 232 are understood to mean the fiscal year, or the bounty year, commencing July 1.

Notice and Application for License.

All producers of sugar who intend to apply for the bounty on sugar produced during the year from July 1, 1891, to July 1, 1892, in order to entitle themselves thereto must, after April 1 and prior to July 1, 1891, file a notice and make application for a license.

This notice should be in duplicate, and be filed with the Collector of Internal Revenue of the proper district, who will retain one copy and forward the other to the Commissioner of Internal Revenue.

The application for license will be on the same form as the notice.

Producers of sugar from beets, sorghum, or sugar cane will use Form No. 287 for giving the notice and making the application required.

Producers of sugar from maple sap in giving their notice and making their application for license will use Form No. 288.

The blanks in these forms should be properly filled, and in case of any change in the method of manufacture, location, or otherwise occurring subsequently to the date of the notice, a supplemental notice should be immediately given to the Collector of the district or the deputy collector of the division.

The notice and application for license will be required annually hereafter, prior to the first day of July.

(To be continued.)

SUGAR-HOUSE STATISTICS.

The following figures, &c., given in a letter to the *Planters' Monthly*, and for the most part derived from the writer's own personal observation, may be found useful:—

1st. From an average of many samples, I find that a fibre determination of our cane can be reduced to the following rule:—

Multiply the proportion without joint knots by 11 per cent., and the proportion with joint knots by $16\frac{1}{2}$ per cent., allowing $\frac{3}{4}$ inch for each knot.

The figures will give a nearer approximation than a few very accurate average analyses:—

EXAMPLE:—96 inch cane has, say 20 knots,

$96 - 20 \times \frac{3}{4} = 81$ inches $= 84{\cdot}4$ per cent. of the whole cane,

$20 \times \frac{3}{4} = 15$ inches $= 15{\cdot}6$ per cent. of the whole cane,

$$\left.\begin{array}{l}\text{So } 84{\cdot}4 \times 11 \text{ per cent.} = 9{\cdot}28 \\ 15{\cdot}6 \times 16\tfrac{1}{2} \text{ per cent.} = 2{\cdot}57\end{array}\right\} 11{\cdot}85 \text{ per cent. fibre.}$$

The nearer the knots are to each other so much the more fibre, and the longer the joints the less fibre.

2nd. Extraction is frequently desired where it is impossible to measure the juice, but where the cane and bagasse are weighed, the fibre given, and the normal Brix from the three rolls and the diluted juice from the auxilliary rolls recorded, the following is near enough for practical work:—

EXAMPLE:—100 tons Cane, Fibre 12 per cent., Normal Juice Brix 20, Dilute juice from 2 Rolls, 5 Brix, Bagasse 25 tons;

$100 - 12 = 88$ per cent. juice in Cane,
$88 \times \cdot 20 = 17 \cdot 60$ solids in juice,
$25 - 12 =$ dilute juice in Bagasse,
$13 \times \cdot 05 = \cdot 65$ lost solids in Bagasse,
$17 \cdot 60 - \cdot 65 = 16 \cdot 95$ or $96 \cdot 3$ per cent. of $17 \cdot 60$.

So $100 : 96 \cdot 3 :: 88 = 84 \cdot 7$ per cent. the extraction in terms of Cane.

Comparisons between milling and diffusion ought to be rendered as above in percentage of juice extraction.

3rd. Dilution and Evaporation should be rendered on the normal juice as under:—

Normal Juice Brix 20, Dilute Brix 14, dilution is $\frac{20-14}{14} \times 100 =$ $42 \cdot 9$ per cent., or for every 100 lbs. Normal Juice we have added $42 \cdot 9$ lbs. of water.

Evaporation from, say Brix 18, to Brix 39, is—$39 - 18 = \frac{21}{39} \times 100 =$ $53 \cdot 8$ per cent.

The application of so simple a calculation would sometimes prevent exaggerated reports of what is being done in dilution without additional fuel.

4th. Tracing the juice through the boiling-house, it appears that very little inversion is apparent until it is depositing crystal in the vacuum pan; juice entering the vacuum pan should be slightly alkaline, litmus-paper is the most frequent indicator, but phenolphthalien is better for the purpose at this stage.

The following is useful:—

Baume to Brix $\times \frac{9}{5}$. Brix to Baume $\frac{5}{9}$.

Brix to Spec. Gravity $\frac{259}{259-\text{given Brix.}}$ S. G. to Brix $\frac{259}{259-\text{S. G.}}$

Baume to Spec. Gravity $\frac{144}{144-\text{given Baume.}}$ S. G. to Baume $\frac{144}{144-\text{S. G.}}$

Specific Gravity to weight in lbs. per Imperial Gallon, remove decimal point one figure to right.

NOTICES OF BOOKS.

We continue our notices of the publications of the "Midden-Java" Experimental Station (Mededeelingen vat het Proefstation, Midden-Java" te Semárang), which we commenced in the March number and continued in the April numbers; the Dutch titles and prices will be found on page 158.

CHEMICAL ANALYSES OF SUGAR CANE FROM THE "VARIETIES-GARDEN" AT SAMARANG. By P. H. Meulemans.

The regular analyses of various varieties of cane, which were made by the late Dr. Soltwedel, are here continued, and the results tabulated for 1889-90.

ON THE ACCURATE NAMING OF THE VARIOUS GENERATIONS OF SUGAR CANES AND OF SEED CANES, OBTAINED FROM IMPORTED SEED. By Dr. Franz Benecke.

The four pages royal 8vo. of this pamphlet are devoted to a painstaking attempt to introduce a recognised system of nomenclature by which the canes which are indigenous to a special district or country shall be distinguished in their different generations. It is too technical to be described more fully, but indicates the accurate way in which the working is conducted at the Midden-Java Station.

ABNORMAL PHENOMENA IN CONNECTION WITH THE SUGAR CANE. By Dr. Franz Benecke. With 17 Figures and 8 Plates.

This seems to us to be, with the exception of "Over Zuikerriet uit Zaad" (now out of print), to be the most interesting, and certainly the most important, pamphlet of the series. It consists of 53 pages, and is accompanied by illustrative figures which are very helpful in following the statements and arguments of the author. We may here remark that all these engravings are on a folded sheet, so as to admit of lying open by the side of the text to which they relate, an enormous convenience.

In the introduction the writer lays stress on the necessity of studying what is the true method of producing a definitely sound sugar-cane plant. He had at one time hopes of being able to produce such plants from the seed of the cane, but his hopes are growing faint, if not almost given up, and he promises a sequel to "Over Zuikerriet uit Zaad" which will deal with this question.

Dr. Benecke has apparently had to labour under many disadvantages from want of accuracy on the part of the planters to whom he addressed questions, in the hope of getting wider range of information, and to have been thrown very much on his own resources in forming conclusions. Such experiences fall to the lot of most of those who endeavour to reduce to scientific accuracy operations, no matter of what kind—weaving, dying, cultivating, or what not—which have from the earliest times been conducted by "rule of thumb." The results of the experiments he has made are given under the following six heads:—

I. "Sereh" disease at a stage of unusual development in the case of young plants.

II. Misshapen joints (malformations).

III. Knots without eyes.

IV. Canes with varying inflorescence.

V. Leaves all rolled up together.

VI. Yellow and white leaves.

The third division has by far the largest space devoted to it. In July, 1890, Dr. Benecke received a cane which powerfully attracted his attention, from the fact of the joints having no sprout-eyes. The 7th and 6th internodes (commencing from below) were beset with root-eyes, just where the sprout-eye should have been. The 5th internode was abnormal, having a sort of imperfect joint, on which there was an abortive sprout-eye. The remaining internodes had no sprout-eye; the same with those of the upper stem. This led him to examine carefully the various kinds growing in the experiment-field or Semárang, with a view to find how far such regularities existed there. An unexpected number of these were met with, and an elaborate argument leads to the hypothesis on the part of Dr. Benecke, based on the study of the possible causes of these variations, that nature herself has indicated, in the clearest manner, that only the upper portion of the cane should be used for propagating the plant, in other words, for seed.

The last of the 1890 series of these pamphlets is entitled:—On the Consequences of Continuous Multiplication of Phanerogamous Plants by non-sexual means. By Dr. M. Möbius, of Heidelberg, with Introduction by Dr. F. Benecke.

The circumstances which gave rise to the writing and publication of this pamphlet of 30 pages are stated by Dr. Benecke, in his

preface, to have been the objections which were made in certain quarters, more especially by Mr. E. Du Bois, the well-known Editor of "De Landbouwer," to the view enunciated by Drs. Benecke and Krüger, that the "sereh" disease was by no means to be attributed to the failure or degeneration of the cane from senility. The assumption—that the cane had become degenerate through continual reproduction in a way other than that provided by nature, *i.e.*, by planting cuttings instead of sowing seed, and hence was more exposed to attacks of parasitic and other diseases, and less able to resist them—seemed to require refutation, and Dr. Benecke felt that he had neither time nor material at hand to endeavour to refute it. He, therefore, addressed himself to Dr. M. Möbius, lecturer on Botany at the University of Heidelberg, and this pamphlet is the result. We have read it with great interest, and would recommend its perusal to all who are interested in the question; the copy before us is in Dutch, but it is more than probable that a German copy might be obtained by applying to Dr. Möbius direct. Our limits, unfortunately, will not allow of anything like a review of the very exhaustive and valuable *brochure*, but we shall just note the main points which, in our opinion, are fairly established by the writer. These are as follows:—

Regarded from a theoretical point of view, the supposition that continual reproduction by vegetative means—(*i.e.*, other than by seed), leads to degeneration and senile weakness, is unfounded. The words of Darwin are quoted: "That plants can be propagated for lengthened periods by germination, without the help of sexual reproduction, may be confidently assumed from the fact that this is the case with many plants which must have been long in existence in a state of nature."

Facts (adduced at length), show that the reproduction by vegetation is by no means so unnatural that cultivators, in availing themselves of this method, are acting in any way that is not also made use of by nature. As regards cultivated plants, there are amongst them some, which for at least a very long time have been exclusively propagated vegetatively, without betraying any sign of weakness as a consequence of age. The writer cites the banana, of which it is not known that its cultivation by shoots for many thousand years has resulted in its being less productive or its suffering from epidemic disease; the date palm, which (although it produces seed) is

propagated by cuttings, and has probably been so cultivated as long as the banana, yet there is no mention of its suffering from any disease; where unproductiveness occurs it is owing to imperfect impregnation of the female blossom or damage from locusts, ants, &c. So with the batata, yam, and other plants cultivated by roots, shoots, &c., for many hundreds of years.

Reference is made to the appearance of potato disease, and the experiments made with seed instead of tubers in Holland and North Germany, resulting in the conviction that plants so obtained were equally exposed to the disease with the usual kinds, and that the disease was due to external circumstances.

The conditions with regard to fruit trees are found to be in no way different from those which obtain in the case of the other cultivated plants which have already been discussed. It is therefore *not to be expected that the diseases which attack our cultivated plants can be averted by changing the mode of their reproduction or propagation*, but that to attain their object we must seek for means to destroy the causes of the disease.

It is considered as proven that there exists absolutely no reason to assume that the sugar cane, by continuous propagation by means of cuttings, has become weak in consequence of senility, and that the "sereh" disease can be combatted by propagating the cane in future no longer by cuttings but by sexual means, *i.e.*, through its fructification.

We have just received two other publications of the series, the 1890 portion of which we have now noticed in the present and two preceding months' issues; we shall reserve those of 1891 for later consideration, repeating the assertion of our conviction that these pamphlets form valuable contributions to the study of the growth and cultivation of the cane, and the phenomena attending it, whether of a diseased or healthy nature.

Correspondence.

TO THE EDITOR OF "THE SUGAR CANE," MANCHESTER.

SIR,—In your issue of February 2nd, 1891, appears a letter from Mr. Frederic J. Scard, of Demerara, calling in question the figures and statements made by the writer in a letter which appeared in your journal, December of last year.

Mr. Scard is introduced to your readers as a well-known and

experienced chemist, and it is significant that his communication was handed to you by Mr. Nevile Lubbock.

While it is not intended to inaugurate an epistolary war on the question of Mills *v.* Diffusion, a question which every sugar planter will have to decide for himself, the statements made by Mr. Lubbock in your issue for September of last year, and the facts quoted by Mr. Scard in the number before mentioned class with each other so greatly, that in justice to the cause of diffusion, it would seem that an investigation into the discrepancy noted is very desirable.

Turning to Mr. Lubbock's letter in your September issue, we find the following figures as regards double crushing, which we may safely presume to be the results of his observations as average work done in Demerara.

Extraction by dry double crushing on weight of cane..	72%
Fibre in cane	13%
Sugar left in megass	2·6%

and *one ton of sugar obtained from eleven tons of canes!*

Mr. Lubbock's friend, Mr. Scard, is not so liberal with figures, he simply states in your February number that 72% extraction on weight of cane does not represent merely 80·9% of sugar in cane but 86% (!), and we are expected to take his *ipse dixit* for this, as no supporting figures or results of analyses are adduced.

Let us examine the figures set forth by Mr. Lubbock in his September letter, as Mr. Scard has given none, and see if Mr. Scard's statement will bear scrutiny on a practical basis.

Taking the usual method of computing extraction first, and applying Mr. Scard's correction afterwards, we will compare the results with figures obtained in these islands, and also with figures from Queensland.

Mr. Lubbock's figures:—28% megass resulting from the crushing of cane to 72% extraction is composed of 13 parts fibre, 2·6 parts sugar, the balance impurities and water. The quotient of purity of juice in megass may be placed at 89%, it will certainly not exceed this on the average; then the total soluble solids in this juice will be $\frac{2·6 \times 100}{89} = 2·92$, and as this stands the Brix reading of the juice left in megass is $\frac{2·92 \times 100}{15} = 19·46$; and as we assume the extracted juice to have the same composition, there is expressed from every hundred pounds of this cane 72lbs. of juice standing Brix 19·46 with

a quotient of purity of 89%, and consequently the weight of the sugar in this juice is $72 \times 19 \cdot 46\% = 14 \cdot 01$lbs. solids $\times$ 89% purity $= 12 \cdot 47$lbs. sugar extracted from every 100lbs. canes, $12 \cdot 47 \times 2 \cdot 6 = 15 \cdot 07\%$ sugar in cane on its weight. There being 12·47lbs. sugar extracted from every 100lbs. cane, the extraction from 1 ton or 2,000lbs. cane $= 12 \cdot 47 \times 20 = 249 \cdot 4$lbs. per ton cane; but we are informed that on the average eleven tons of canes produce one ton commercial sugar; and there has been extracted according to the foregoing $249 \cdot 4 \times 11 = 2743 \cdot 4$lbs. sugar from 11 tons of cane, but there has been recovered of this amount but 2,000 lbs. with a loss of 743·4 lbs. a loss in manufacture after extraction of $\frac{743 \cdot 4 \times 100}{2743 \cdot 4} = 27 \cdot 1\%$ and this be it remembered includes the impurities in the commercial sugars.

Applying Mr. Scard's correction:—28% megass resulting from crushing cane to 72% extraction (we assume for comparison that 13% or 11% fibre in canes will make no difference to the correction to be added for 72% extraction) is composed of 13 parts fibre, 2·6 parts sugar, balance water and impurities, according to Mr. Scard the 2·6 parts of sugar left in megass is 14% of sugar contained in the cane, consequently $\frac{2 \cdot 6 \times 100}{14} = 18 \cdot 57$ lbs. sugar per 100 lbs. canes, and $18 \cdot 57 - 2 \cdot 6 = 15 \cdot 97$lbs. sugar extracted per 100lbs. canes, $15 \cdot 97 \times 20 = 319 \cdot 4$ lbs. sugar per ton cane, and $319 \cdot 4 \times 11 = 3513 \cdot 4$ lbs. sugar extracted from 11 tons of cane, of which on the average 2000lbs. are finally recovered, leaving 1513·4lbs. as loss in manufacture or $\frac{1513 \cdot 4 \times 100}{3513 \cdot 4} = 43\%$ which is of course an absurdity.

Mr. Scard's supposition that we are in ignorance of the alleged fact regarding extraction of sugar, referred to in his letter, is quite erroneous, we are well informed and know that the difference in content of sugars in juice extracted and juice left in megass is proportional, or nearly so, to the difference in the quotients of purity, and also that the greater the extraction of juice from the cane, the less the difference is in the quotients of juice extracted and juice left.

We are, of course, entirely in the dark as to work in Demerara, but in this country the differences noted above are so trivial as to be generally neglected as not affecting the final results.

The results of a season's work in the year 1888, from eight mills in Queensland, are at hand, and briefly quoting, are :—

Double crushing and maceration, 25 lbs. water added per 100 normal juice.

Extraction of sugar, calculated on sugars left in megass = 90·8%
Recovery of dry sugars of all grades reduced to pure sugar.. 74·5% of total sucrose in cane.
Total losses calculated on sugar in cane .... 25·5%
Losses in manufacture .... 16·3%

Work done by a six-roller mill on the Island of Main, mill consists of three pairs of two rollers each, maceration practiced between the last pairs of rolls.

Extraction in terms of sugar in cane calculated on sugar left in megass 91%
18 lbs. of water per normal juice used in maceration.
No returns for losses in manufacture.

Now, if by double crushing in powerful mills, aided by liberal maceration or water added to the megass on its way to the last squeeze, an extraction of barely 91% can be obtained, the statement that dry double crushing to 72% extraction means 86% extraction of sugar, seems to us to be somewhat extravagant, and we beg to call upon Mr. Seard for proof that his assertion is accurate.

With regard to coal consumption, it may be interesting to the readers of *Sugar Cane* to know that one diffusion plant is working on these islands this season, using but $\frac{15}{100}$ ton of coal per ton of sugar made, and is turning out sugar at the rate of 300 tons per week; and that three other diffusion plants are at work, using from $\frac{1}{3}$ to $\frac{1}{4}$ ton coal per ton sugar.

In conclusion, Mr. Editor, we would say that these humble efforts in behalf of diffusion are not put forward in the least expectation of finally determining the question at issue; if the apparatus for diffusion once gets a fair start, it will soon push itself to the front, as it has already done in the beet industry to the great satisfaction and profit of those engaged in it.

Very truly yours,

J. N. S. WILLIAMS.

Honolulu, Hawaiian Islands,
March 10th, 1891.

CUBA.

There is uncertainty as to the quantity of the Cuban crop, as there is much more cane in the fields than can be ground. The *Havana Weekly Express* says the only particulars ascertainable with regard to the new process in use at the "Constancia" Central factory, to which we have alluded, are as follows:—

The molasses to be operated upon are divided into two determined parts, of which one is mixed with water to 30° and the other to 12° Beaumé; the first is mixed with the cane juice as it comes out of the mill, and the second is poured, by means of a perforated tube, perpendicularly to the set of rollers upon the bagasse, as fast as it is expelled from the rollers of the first crushing.

The mixture of molasses, water, and cane juice is then made to pass into tanks in which a sufficient quantity of lime milk, at 20° Beaumé, is added to it, to determine a free alkaline action, and it is afterwards introduced into the clarifiers and treated in the usual manner.

Some people positively affirm that before it is mixed with water, the molasses to be worked upon is submitted to the action of a certain reactive, whose formula is the secret of the inventor.

The fact is that central "Constancia" is yielding to-day 10½ % of the gross weight of the cane, in first-class sugar, without second class or molasses, whereas the best results heretofore attained last year on the island, on two of the most skilfully managed estates using cane shredders, double crushing and improved apparatus of all sorts, were 9·68 and 9·45 %.

The same journal contains the following remarks:—

"Reports regarding the results obtained with this process on the plantation on which it has been installed are rather contradictory, and in spite of all that the *Revista de Agricultura* says about the satisfactory yield that is being attained on estate 'San Joaquin,' of Count Ibanez, according to other parties, for one reason or another, the extraction is inferior to that obtained by the double crushing of the cane; one fact worthy of special mention, is that neither of the two other plantations, 'Montana,' also of Count Ibanez, and 'Caracas,' of Messrs. Terry Brothers, on which diffusion batteries were also mounted last year, is working this year with that process, which seems to indicate that their owners do not find it advantageous to their interests to run them instead of their mills.

"The *Revista de Agricultura* attributes the small quantity of sugar produced on estate 'San Joaquin' to the deficiency of the evaporator used on the plantation, which instead of evaporating 80 hhds. of sugar each day, as calculated when mounted, hardly turns out 20, and that with great difficulties and frequent interruptions for cleaning, the capacity of the diffusory battery being 1,035 tons of cane daily, which the cutting apparatus can easily prepare in chips, whereas owing to the deficiency of the evaporator, the largest quantity which could be worked in one day was of 655 tons only."

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; 63, Long Row, Nottingham; and 323, High Holborn, London.

ENGLISH.

APPLICATIONS.

3736 Matthew Blake and John Barclay, Glasgow. *Improvements in and relating to sugar cane mills.* 2nd March, 1891.

4089. W. H. Munns, London. (Communicated by Alexander Olsen, United States.) *An improved crushing mill.* 7th March, 1891.

4817. Reginald Walter Barker, London. (Communicated by Henry Goodacre, United States.) *Improvements in filters.* 18th March, 1891.

5191. A. Wohl and A. Kollrepp, London. *Improvements in the production of invert sugar.* 24th March, 1891.

5236. A. Schneller and W. J. Wisse, London. *Improvements in the refining or extraction of sugar from raw sugar solution, juice, or molasses.* 24th March, 1891.

5555. R. Haddan, London. (Communicated by J. W. Evans, United States. Complete specification.) *Improvements in evaporators.* 31st March, 1891.

5897. J. Murrie, Glasgow. *Improvements in and relating to feed apparatus for steam boilers or evaporators, applicable also for steam traps, or other purposes.* 6th April, 1891.

6186. E. Martin, London. *Improvements in filtering machinery.* 10th April, 1891. (Complete specification.)

ABRIDGMENTS.

5283. G. F. REDFERN, of 4, South Street, Finsbury, Patent Agent. (Communicated from abroad by MORIZ WEINRICH, of St. Louis, Missouri, U.S.A.) *Improvements in the manufacture of sugar.* April 5th, 1890. This invention relates to the filtering and purification of saccharine or other solutions, in order to separate in a quick and easy manner all matters held in suspension. The novelty apparently consists in treating the solutions with one or more of the following substances, viz. :—Bagasse, maize, ground cork, or sugar cane. These are comminuted or ground into meal or flour. Several methods of employing the substances are described according to one, the solution is first heated to about 130° F. and about 2% of the substance is stirred in the mixture heated to boiling point. Certain chemicals, such as lime, and a neutralizing acid such as phosphoric acid are added, and the liquor is then filtered through a layer of the substance. The latter may be cleaned and used again.

7881. J. SZCZENIOWSKI and G. PIATKOWSKI, of Kapusciany, Russia. *Engineers for centrifugal machine operating continuously, automatically emptied and provided with a regulator.* April 5th, 1890. The lid of the basket has a deep depending flange which surrounds the said basket when in position. According to the height at which the lid is placed there is a greater or less surface free for the passage of the material through the sides of the basket.

AMERICAN.

ABRIDGMENTS.

441317. JAMES A. MORRELL, of Lansdale, assignor of one-half to G. W. MARSH, of Philadelphia, Penn., U.S.A. *Process of concentrating solutions.* November 25th, 1890. This consists in mechanically agitating and moving the solution under pressure while being heated above its normal boiling point, spraying it against a screen whereby it is precipitated from the said screen in an atomised condition, and allowing it to pass while in this condition through a heated chamber, and finally collecting the concentrated product. Drawings are given showing an apparatus suitable for carrying out the above process.

GERMAN.

ABRIDGMENTS.

54365. JOSEPH ORLOWSKI, Niemiercze, near Mohileff, Podolia, Russia. *Apparatus for testing the quality of beet root, &c.* 8th May, 1890. The roots are placed horizontally upon a table between two

conical adjustable holders, which, by means of a lever with which they are connected by a guide, either approach or recede from one another. These holders, by means of the length of the guide, hold the roots, in spite of their varying sizes, so firmly between them that a tube-shaped knife, adapted to move vertically over the table, picks up the test root at one relatively fixed position of the root. The sample root is then removed by means of a rod and hand-lever, the rod being connected with the hollow knife.

54366. E. Schmidt, Vienna. *Improved process applicable for the purification of raw sugar.* 24th May, 1890. The raw sugar is mixed with porous light materials, such as cork, bagasse, charcoal, or bone-black, in pieces of about 2 mm. in diameter, or with saw-dust, and the mixture lixiviated with inferior syrup in a diffusion battery. The light porous material that has been added renders the mixture spongy and elastic, so that the syrup easily penetrates the same, while without this loose material the sugar would collect together and the lixiviating process be rendered more difficult. The mixture of purified sugar and porous material is, in case the sugar needs further refining, dissolved in a little water, when the material can be removed by means of a sieve, but should marketable sugar be required at once, it is passed in its dry form through the sieve.

54832. Fr. Rassmus, Magdeburg. *Improved apparatus applicable for holding suction filter frames firmly.* 27th March, 1890. In this filter, the filter frames, surrounded by the liquid to be filtered, are fixed loosely upon the collecting pipe used for the discharge of the filtrate, and only connected with the latter by conical stays, fixed one within the other. In order to render this connection more secure and prevent the frames from being raised out of position, which is sometimes the case when the filter cloths become clogged, and thus prevent the possibility of the loosening of the same, the upper ends of two springs are arranged to engage over the edge of the pipe cone with the frames.

IMPORTS AND EXPORTS (UNITED KINGDOM) OF RAW AND REFINED SUGARS.

JANUARY 1ST TO MARCH 31ST.

Board of Trade Returns.

IMPORTS.

RAW SUGARS.	QUANTITIES.		VALUE.	
	1890.	1891.	1890.	1891.
	Cwts.	Cwts.	£	£
Germany	1,462,750	1,540,080	848,763	964,901
Holland	110,874	139,921	59,643	83,197
Belgium	317,494	444,795	160,544	262,344
France	657,951	580,070	401,709	384,849
British West Indies & Guiana	370,100	315,476	287,373	250,320
British East Indies	52,670	71,345	23,019	40,366
China and Hong Kong	....	....	....	....
Mauritius	773	19,330	487	11,974
Spanish West India Islands	....	....	....	....
Brazil	93,396	256,384	55,491	152,763
Java	150,242	400,708	119,245	301,571
Philippine Islands	35,600	224,688	17,435	121,319
Peru	227,556	128,656	155,038	90,163
Other Countries	98,451	120,335	69,986	85,000
Total of Raw Sugars	3,577,857	4,241,788	2,198,733	2,748,767
Molasses	29,288	91,560	11,141	32,643
Total Sugar and Molasses	....	....	4,109,762	4,708,196
REFINED SUGARS.				
Germany	1,105,050	1,228,067	895,954	1,001,174
Holland	413,428	371,796	344,305	314,639
Belgium	43,257	63,417	38,945	54,423
France	770,600	527,315	619,915	440,169
United States	377	131,390	696	110,469
Other Countries	98	7,201	73	5,912
Total of Refined	2,332,810	2,329,186	1,899,888	1,926,786

EXPORTS.—REFINED SUGARS.

	1890.	1891.	1890.	1891.
	Cwts.	Cwts.	£	£
Sweden and Norway	19,827	18,991	14,158	14,396
Denmark	25,198	34,598	14,863	21,697
Holland	20,798	25,731	14,771	18,346
Belgium	6,569	5,636	4,471	3,902
France	3,021	26	1,922	22
Portugal, Azores, & Madeira	24,124	22,524	15,501	14,916
Italy	24,832	10,529	16,302	7,292
Other Countries	49,140	62,044	37,103	48,400
Total of Exports	173,509	180,079	119,091	128,971

IMPORTS OF FOREIGN REFINED SUGAR.

The British Sugar Refiners' Committee furnish us with the following figures, giving the imports of foreign refined sugar for the month of March, 1891, compared with the corresponding month of the two preceding years, and the average monthly imports for the past year compared with those of 1887, 1888, and 1889, distinguishing the quantities of "Lumps and Loaves" from "other sorts," and giving the separate imports from each country:—

Countries from which Sugar has been imported.	"Lumps and Loaves."							"Other Sorts." Including Crushed Loaf, Granulated, Crystallized, &c.							Total.						
	Monthly Average.				Mar.	Mar.	Mar.	Monthly Average.				Mar.	Mar.	Mar.	Monthly Average.				Mar.	Mar.	Mar.
	1887	1888	1889	1890	1889	1890	1891	1887	1888	1889	1890	1889	1890	1891	1887	1888	1889	1890	1889	1890	1891
	Tons.	Tons.	Tons.	Tons.	Tons	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France..............	1363	1686	2373	2707	2093	3946	1801	5099	4855	8596	8547	2950	6019	6810	6462	6541	10969	11254	5043	9965	8611
Holland	3780	3267	2294	2858	3578	2836	3913	2483	2675	3354	4580	3708	4242	3677	6263	5942	5648	7438	7286	7078	7590
Germany & Austria ..	1347	1510	2573	2512	3057	2549	1776	10463	11729	13844	18333	12913	16211	20683	11810	13239	16417	20845	15970	18760	22459
Belgium	592	622	827	390	1343	442	1008	308	227	225	344	205	225	392	900	849	1052	734	1548	667	1400
United States	454	8	..	96	..	..	..	2804	157	42	1123	111	5	520	3258	165	42	1219	111	5	520
Russia..............	3	..	23	25	..	..	..	452	1959	2015	29	5286	..	300	455	1959	2038	54	5386	..	300
Other Countries	..	1	239	..	..	..	..	15	2	355	..	28	..	..	15	3	594	..	28	..	..
Total	7539	7094	8329	8588	10071	9773	8498	21624	21604	28431	32956	25301	26702	32382	29163	28698	36760	41544	35372	36475	40880

SUGAR STATISTICS—GREAT BRITAIN.

FOR THE FOUR PRINCIPAL PORTS.

To April 16th, 1890 and 1891.

In Thousands of Tons, to the nearest Thousand.

	STOCKS.		DELIVERIES.		IMPORTS.	
	1891.	1890.	1891.	1890.	1891.	1890.
London	29	31	91	87	94	68
Liverpool ..	35	61	92	87	75	62
Clyde	50	47½	61	66	75	74
Bristol	3½	1½	20	21	20	20
Total ..	117½	141	264	261	264	224

The above figures do not represent accurately, or to the full extent, the position and movements of sugar in the United Kingdom, as Hull, Leith, &c., are not included, there being no published returns for these ports.

SUGAR STATISTICS—UNITED STATES.

(From Willett & Gray's Report.)

For the four principal Ports. In Thousands of Tons, to the nearest Thousand. For March, 1890 and 1891.

	STOCKS. April 1st.		DELIVERIES. In March.		IMPORTS. In March.	
	1891.	1890.	1891.	1890.	1891.	1890.
New York	20	9	91	63½	89½	69
Boston	4	..	27½	16	27	13
Philadelphia....	3½	..	34	23½	35½	23
Baltimore	..	..	2	..	2	..
Total.....	27½	9	154½	103	154	105
Total for the year..........			349	293	348	291

NEW YORK PRICES FOR SUGAR.

From Willett & Gray's Report, April 16th, 1891.

Fair Refining.	96o/o Centfs.	Granulated.	Stand. A.	Stock in Four Ports.
April 16, 1891.—3 3-16c.*	3½c.*	4½c.	4⅜c.	Jan. 1, 1891— 27,756 tons.
April 17, 1890.—5c.	5½ 9-16c.	6 3-16c.	5 15-16c.	Jan. 1, 1890— 11,169 tons.
April 18, 1889.—6 5-16c.	7¼c.	8¾c.	8⅜c.	Jan. 1, 1889— 32,254 tons.
April 19, 1888.—4 13-16c.	5½c.	6¾c.	6¼c.	Jan. 1, 1888— 47,798 tons.
April 21, 1887.—4 9-16c.	5 3-16c.	5 11-16c.	5 5-16c.	Jan. 1, 1887—102,279 tons.
April 22, 1886.—5⅛c.	5 13-16c.	7 7⅛c.	5½-⅝c.	Jan. 1, 1886— 57,328 tons.
April 23, 1885.—4 9-16c.	5 5-16c.	6c.	5½c.	Jan. 1, 1885— 89,186 tons.
April 17, 1884.—5⅝c.	6 5-16c.	7c.	6⅝c.	Jan. 1, 1884— 60,900 tons.
April 19, 1883.—6 15-16c.	7⅝c.	8⅞c.	8⅝c.	Jan. 1, 1883— 50,297 tons.
April 23, 1882.—7½c.	8 9-32c.	9⅝c.	9½-⅝c.	Jan. 1, 1882— 43,927 tons.

* Net Cash.

STOCKS OF SUGAR IN THE CHIEF MARKETS OF EUROPE ON THE 31ST MARCH, 1891, FOR THREE YEARS, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal entrepôts	TOTAL 1891.	TOTAL 1890.	TOTAL 1889.
120	405	295	295	45	24	1184	1107	734

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING 31ST MARCH, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal entrepôts	TOTAL 1891.	TOTAL 1890.	TOTAL 1889.
1343	526	493	303	56	384	3105	2910	2817

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE PRESENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1890-91. Tons.	1889-90. Tons.	1888-89. Tons.	1887-88. Tons.
German Empire..	1,335,000 ..	1,264,607 ..	990,604 ..	959,166
France	700,000 ..	753,078 ..	466,767 ..	392,824
Austria-Hungary.	760,000 ..	787,989 ..	523,242 ..	428,616
Russia	530,000 ..	456,711 ..	526,387 ..	441,342
Belgium........	200,000 ..	221,480 ..	145,804 ..	140,742
Holland	65,000 ..	55,813 ..	46,040 ..	39,280
Other Countries..	80,000 ..	80,000 ..	87,000 ..	79,980
	3,670,000	3,619,678	2,785,844	2,481,950

While admitting that over the whole of Enrope an increase in the quantity af beet grown must be expected, Mr. Licht considers that there is, as yet, no certainty of a corresponding increase in the quantity of sugar produced, and therefore leaves his estimate unchanged.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

The month of April has been rather a disappointing one as regards cane sugars; the quantity of West India coming to this market has been small, and the business done has been almost confined to Java and East India sorts. Prices may be quoted at about 6d. per cwt. lower all round, excepting for East India and South American sorts, which remain unchanged.

The refined market opened after the Easter holidays with an improved demand, but this soon fell off, and for the past three weeks there has been no animation, but prices are maintained, as we last month intimated would probably be the case, owing to the small profits realised at present rates.

Contrary to the expectation of most, beet has not maintained its position. This may possibly be owing to the expected larger sowings in most Continental countries, but, to a great extent, must result from the effect of the change in America having been largely discounted. Transactions for the American market were reported heavy at the beginning of the month, but appear to have fallen off, and refiners here are not inclined to operate. There is a possibility that we may have more sugar this year than we require up to the new beet crop, and the season being so backward has had a considerable effect on the demand. On the whole, it is difficult to explain the general situation, as it does not accord with what we should have expected. Prices of beet sugar are about 6d. lower than at the end of last month.

Present quotations for the standard qualities, as under, are :—

FLOATING.			Last Month.
Porto Rico, fair to good Refining	13/3 to 14/3	against	13/6 to 14/6
Cuba Centrifugals, 97°/. polarization	15/-	,,	15/6
Cuba, fair to good Refining	13/6 to 13/9	,,	13/9 to 14/-
Java, No. 14 to 15 D.S.	15/3 to 15/6	,,	15/9 to 16/-
British West India, fair brown	12/9	,,	13/-
Bahia, low to middling brown	11/- to 11/6	,,	11/- to 11/6
,, Nos. 8 to 9	12/6 to 13/-	,,	12/6 to 13/-
Pernams, regular to superior Americanos..	11/9 to 13/6	,,	11/9 to 13/6
LANDED.			**Last Month.**
Madras Cane Jaggery..	10/6	against	10/6
Manila Cebu and Ilo Ilo	10/3	,,	10/3
Paris Loaves, f.o.b...	17/6	against	18/-
Russian Crystals, No. 3, c.i.f.	15/7½ to 15/9	,,	15/9 to 16/-
Titlers	18/9	,,	18/9
Tate's Cubes..	20/6	,,	20/6
Beet, German and Austrian, 88%, f.o.b. ..	13/6	,,	13/10½ to 14/-

THE
SUGAR CANE.

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☞ The writers alone are responsible for their statements.

All communications to be addressed and all cheques, &c., made payable to "Edward Sutton, Editor of The Sugar Cane, Manchester," which address is sufficient.

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We would call special attention to the translation of a portion of the speech of Dr. Witte in the German Reichstag, which may be of use to our readers in dealing with the singularly contradictory views which are being published respecting the effect of the eventual abolition of the German sugar bounties. The agitation for a trial of home-grown sugar will receive an impetus from the course taken by the German Government, and we have just received the interesting news that the Lavenham factory has been purchased by an enterprising local firm, and that another experiment, on an extended scale, is to be made with English grown beets, and the production of sugar from them.

The Bohemian Sugar Manufacturers' Exhibition at Prague was opened with great *éclat* on the 15th ult., and we feel sure that visitors from our country will not only be heartily welcomed, but will gain valuable experience from an inspection of the machinery and the detailed tabular statements of results of working, which will be available in every case.

From Barbados the reports are rather more hopeful, and some of the estates provided with steam power are expecting to average 2 hhds. to the acre.

We have reprinted (on pages 313 to 317) from *The Queenslander* a paper on the Sereh Disease in the Cane, by the Inspecting Chemist of the Colonial Sugar Refining Company, which gives a tolerably exhaustive account of what is hitherto known respecting this malady,

the results of which have been so disastrous to the planting interest in Java. We may remark that the exact statement made by Dr. Benecke, referred to by Dr. Kottmann (the writer of the above paper), with regard to the cane obtained in a certain experiment, was that "so long as the cause of the *sereh* disease remains unknown, and we do not know with certainty which of the diseased phenomena observed is a consequence of the *sereh* disease, we cannot certify accurately any plant as sound or free from *sereh*."

And as regards the theory referred to in the last paragraph of Dr. Kottmann's paper, we would refer those interested to our review, on page 266 of the *Sugar Cane* for May, of Dr. Möbius' paper "On the Consequences of the Continuous Multiplication of Phanerogamous Plants by Non-Sexual Means."

We extract the following from the *Honolulu Pacific Commercial Advertiser*:—

"We are enabled by the kindness of Mr. Arthur T. Robinson, a sugar planter himself, and a gentleman fully cognizant of the details of the cultivation and manufacture of sugar in Mauritius, to give some important points of comparison between the methods, expenses, and details of sugar production here and elsewhere. The soil of the Mauritius is, like ours, volcanic, but having been longer under cultivation requires more artificial fertilizer than is needed here—as yet, but taking plant-cane and ratoon together yields an average of three tons per acre. Mr. Robinson finds that the cultivation in the Mauritius is quite equal to the practice here, but the bringing to the mills and the system of manufacture here is superior to that in the Mauritius. In regard to the cost of labour, the Mauritian planters have a great advantage over the Hawaiian, the cost of the out-of-door labourer in Mauritius amounting to about 12 Rs. per month, including wages, rations, quarters, and medical attendance. The labourers are mostly British East Indian from the three Presidencies. These are vigilantly watched over by inspectors who examine into wage-accounts, housing, hospitals, medical treatment, and every mutual arrangement between employer and employed, much to the relief and satisfaction of the former, and the ever-present knowledge of the latter that they are under efficient protection. The work is all done on the task or job principle, *i.e.*, so many feet or rows of cane to be stripped or cut, or whatever may be on hand, for the specified wages, so that, in fact, a clever workman beginning at daylight has probably

finished his day's work between noon and three o'clock, and the Indian labourer, at the expiry of his engagement, probably re-engages for one year at a time, or finds himself in a position to become a small land holder, grows cane, vegetables, or starts a small dairy farm, and in this position generally manages to make himself a source of endless trouble and annoyance to the neighbouring plantations. Nevertheless, the planters are, as a rule, on the best of terms with their men, who give little trouble and are on the whole sober, honest, and generally satisfactory. One wide difference in the manner of disposal of their produce is not unfavourable to the Mauritian planter. He sells his sugar in the island, chiefly to Arab merchants from Bombay, and is thus relieved at once from all further expense, care, or anxiety. Mr. Robinson has come to these islands after experience gathered not only in the Mauritius but in other sugar growing colonies, for the purpose more particularly of comparing the merits of diffusion as compared with grinding, and takes away with him specimens of the varieties of cane most appreciated in these islands."

A good deal has been said about the process which M. Manoury has been introducing on the Central Factory "Constancia," see our last issue, page 272. The following is from the *Revista de Agricultura*, and the *Havana Weekly Report*:—

"According to a recent cablegram from the American Sugar Refining Company to their agents at this place, all centrifugated sugars, hereafter bought for their account, must be of good quality, if possible, of No. 12 D. S. or better, and free from admixture of molasses, or any other extraneous substance; all sugars which are not so, or have been manufactured by any other process than the usual ones, will be rejected. Further advices inform us that two cargoes from Central 'Constancia,' were rejected in New York by the Trust, and Messrs. Apezteguia, as well as other planters who had adopted the process of mixing molasses with cane juice, have been compelled, despite the satisfactory results thereby obtained, to give it up at once. This determination of the Sugar Refining Company has taken here everyone by surprise, inasmuch as the sugars obtained by the new process have been carefully examined and analyzed by competent parties, who have declared them free from any kind of spurious matters, and of as good a quality as those manufactured by any other process."

According to the *Sucrérie Indigène*, the export of refined sugar from France during the first four months of the year has been 19,779 tons, and the export of raw sugar 19,507 tons less respectively than in the corresponding months of 1890. Since August last year the French exports have fallen off 40,944 tons, while those of Germany and Austria have increased 54,936 tons and 17,970 tons respectively.

The *Journal des Fabricants de Sucre* contains a letter from a subscriber in France engaged in the sugar trade, asking why manufacturers are so unwise as to make such quantities of so-called "sucre blanc," which is *de facto* not white, and is not now saleable abroad, being 1 fr. too dear, and so gets left on their hands, as the inland market requires sugar really white. He points out that if they are so foolish next year, and the yield should be equal to that of 1889-90, then, with 15% more land under cultivation, they will be in a very unpleasant predicament.

A Consular Report from Belgium states that notwithstanding the large quantity of sugar manufactured in Belgium, the retail price of the article is high, viz., 1fr. 10c. per kilo, or $4\frac{13}{16}$d. per lb.

The *Journal des Fabricants* publishes a letter from the Treasurer of the Hitchcock County Bank at Culbertson (Nebraska), stating that they are about to start a beet-sugar factory there, similar to that at Grand Island, and asking that journal to find them a person capable of establishing such a factory.

We hear that Messrs. Oxnard and Sprague have ordered from the Sangerhäuser Actien-Maschinenfabrik, five Kroog Presses and three Baur Presses, for the new Central Factory, now being erected at Adeline (Nebraska).

We have been favoured with voluminous reports from the Agricultural Experiment Station at Nebraska, but owing to the intervention of the "Whit-week" holidays, have been obliged to make our arrangements rather early, and are compelled to leave these and much other valuable matter until July.

A further description of the new Cycle Mill, patented by Mr. C. W. Guy, M.E., will be found on page 291.

We have just learned that the Lavenham Sugar Factory, which has now been closed for some years, has been purchased by an enterprising local firm, who are prepared to grow beets themselves, if the farmers cannot be induced to provide a sufficient supply of the right sort. We hope to say more on the subject next month.

BOHEMIAN SUGAR MANUFACTURERS' EXHIBITION AT PRAGUE.

Opened May 15th, 1891.

We have received from the *Comité für die Collectiv-Ausstellung der Zuckerindustriellen Böhmens*, a communication calling attention to the opening of this Exhibition, and requesting a visit from those interested. We think we shall probably best meet their wishes by translating the greater portion of the letter, and adding the reminder that the fact of the Diffusion System having had its origin in Austria affords a material recommendation of this Exhibition, containing, as it does, all the apparatus necessary for the study of this invention, the adoption of which tends to spread in cane producing countries, though opinions seem as yet by no means settled with regard to its adaptability to the very different material to be dealt with in tropical and semi-tropical countries, as compared with the beet of temperate zones.

(*Translation.*)

Dear Sir,—On the 15th of May in the present year, the opening of the General Exhibition of the Kingdom of Bohemia will take place at Prague. The Exhibition will last until the end of October, 1891.

There will be a special pavilion for the Bohemian sugar industry, in which will be shown :—

1. All products of the sugar industry of Bohemia.

2. Every kind of raw materal, and all sorts of accessories required in the manufacture.

3. All the various institutions founded with the object of contributing to its prosperity.

4. A Retrospective Exhibition, illustrating the development of the industry from its commencement up to the present day, showing all the apparatus, machinery, and processes used in the manufacture of sugar.

In the name of the Committee of Arrangements of the Sugar Exhibition, I take the liberty of inviting all those of your countrymen who are interested in the sugar industry to honour our Exhibition with a visit, and being very desirous that our English colleagues should have a good reception and feel welcome in our midst, I beg you earnestly to give prominence to this matter in your journal, so that a goodly number of those interested may be induced to attend.

(Signed,) HUGO JELINEK.

GERMANY AND THE SUGAR BOUNTIES.

On the 8th and 9th ult., the debate on the third reading of the new German Sugar Duties Bill was opened and brought to a termination so far as the Reichstag is concerned.

The final result of the discussion and voting is as follows:—

The tax upon the raw material is abolished, and in place of the double tax,—one on the beets and the other on the sugar passing into consumption,—the latter alone remains, the rate being reduced to 18 marks per metric centner (100 kilos.) In place of the premiums, varying according to the skill and good management of the manufacturer, which were secured under the old system, there are to be granted on exported sugar for a period (termed the Uebergangs, or transition period) of five years, commencing from 1892-93, open or definite premiums as follows:—On raw sugar, 1·25; on refined, 2·00; and on granulated, 1·65 marks per metric centner (100 kilos.) for the first three years of the period, and for the remaining two years,—1, 1·75, and 1·40 marks respectively. The import duty is fixed at 36 marks per metric centner.

For the year 1891-92, the old legislation, which is as follows, remains in force:—Tax on the beets, 80 pfennig per metric centner; tax on sugar passing into consumption, 18 marks per metric centner.

The new law now has to receive the sanction of the Bundesrath (Federal Council) and of the Emperor; but after what fell from the lips of the Chancellor there is little probability of any alteration being made by these, and we are therefore now in face of a *fait accompli*, the definite movement towards abolition at no very distant date of the premiums in Germany. This has been and remains the clearly avowed object of the German Government; much may happen before 1896-97, but the events and results of every campaign, with all the factors which condition the latter, must be carefully studied during the next few years by all who are concerned for the abolition of these bounties.

As some assistance in this study, we have translated a considerable portion of the speech of Dr. Witte, which has attracted attention in France. This deputy placed on record a proposal for the immediate and definite abolition of premiums, which however could not be carried, as the feeling in favour of letting down the manufacturers gently was so strong, and further, the Chancellor had declared that the

object of this transition period was to give neighbouring States the opportunity of following suit, though the Confederated Governments were not of opinion that the German sugar industry would not be able to hold its own, unless their competitors abolished their premiums. The following is the speech referred to :—

Count Stolberg has declared that we are actuated by ill-will towards the sugar industry, that our proposal (to strike out the paragraph granting an open bounty) was made under a feeling of hostility, and that by it we should materially injure those sugar manufacturers as were working under less favourable conditions than others. I really did not think, after the position which I have adopted during the past twelve years in regard to the sugar question, that I should have had to defend myself against such a reproach. I have been the most accommodating friend of the real interests of the sugar industry in this house, although up to now with but little success, and at the present moment scarcely any clear-minded man can be in doubt that, if my proposals and the facts which, based on the most careful calculations, I have for ten years adduced,—in other words, the resolutions which I have brought forward in connection with those facts, had been adopted by the Federal Governments, the position of the sugar industry in regard to legislation would have been a much more favourable one to-day than it is. In this respect I fully agree with the Imperial Chancellor that if no result should follow from the legislative labours of the present year, you will find yourselves next year in a much more unfavourable position than you do to-day with this wrong defence of a false position.

One thing I can agree with. In the same way as the effect of the bounty has not been, and could not be, equal in the case of all the factories, the effect of the cessation of the bounty and the abolition of the tax on the raw material will certainly not be the same in the case of all. But this is just what has been the unsound and defective result of the legislation hitherto in force, that during a long course of years it has produced, and must necessarily produce, an unsound extension of the beet cultivation and sugar manufacture in Germany. Hence there can be no doubt that if such a radical alteration in the legislation as that now proposed should come into force, then a number—the exact figure I cannot of course specify—of sugar factories which have sprung up in an unsound and incorrect manner must suffer by it. Such things, however, which are a natural conse-

quence of the protectionist system of taxation embodied in the hitherto existing fiscal regulations with regard to sugar, you will not be able to avoid in the case of any similarly situated industry if you undertake a rational and sound revision of the law relating to it.

There has been, both in the preceding discussion and that of to-day, very special regard paid to competition with other countries and to the circumstances which would arise with regard to it, if we abolish the tax on the raw material together with the bounty, while the bounties were maintained in other countries for a longer or shorter period. I have, on other occasions, already had the opportunity of putting a just estimate on this cause of anxiety. In the preceding session, one of the speakers threatened us with the extraordinary American competition, and with the great anxiety that we must feel lest our market in that quarter should be restricted in consequence of the regulations relating to taxation. At the time I was only able to put in a temporary protest, but now I must shortly allude to the matter. The whole story about American sugar production, about which so much noise has been made—and really in quarters where the facts ought to be better known than seems to be the case, judging from the utterances which have been published—the whole affair of the American beet sugar production is a thing that is yet in the clouds; there is as good as nothing practically existing. In spite of all the efforts that have been made, and all the premiums and protective duties that have been granted with the idea of calling into existence the cultivation of beets in America, it only exists on paper. At the present moment there are still only three beet sugar factories in America, which lead a precarious existence.

This is an incontestable fact, and I am fortunately in a position to give you some details from a writer, formerly a member of this House, a weathercock in politics, but to be depended on in matters of national economy. In a late number of the *Deutsche Wochenblatt*, Professor Paasche-Marburg has expressed his views on the position of Germany as regards other sugar-producing countries. With respect to America, he says:—

"Even the great *Verein für die Rubenzuckerindustrie des Deutschen Reichs*, in its appeal to the Imperial Chancellor, of the 7th November, 1890, starts out from the position that the North American agriculturists can cultivate sugar beets with success."

You may suppose from this what will be the tenor of the statements

addressed to the Imperial Chancellor, or the various Governments, even by men so thoroughly at home in the question.

"For years the American journals have teemed with the most hopeful reports . . . . . . and up to now the results of the efforts of ten years is totally unimportant."

Then the three factories, of which I have spoken, are brought in, and further on mention is made as follows of the two cents' bounty of the McKinley Bill:—

"The bounty of two cents, given by the McKinley Bill, is anyway not, as the address of the *Verein fur Rubenzuckerindustrie* would make out, an enormous premium now offered to the agriculturists—it is neither more or less than a substitute for the protective duty which is being taken off, and actually has the effect of making the position of the American producers worse."

This, then, is the bugbear of American competition, which does not frighten me in the least. The article in question proceeds then to discuss, in a very interesting and instructive manner, the position of the sugar industry in tropical countries.

The threat, that colonial cane sugar would at no distant date make an end of us, is, as we know, also one of those things which at the present juncture is being actively brought into publicity. In this article it is fully shown what are the circumstances connected with cane sugar and its production in the Colonies, how the climate, the cost of labour, and all other matters connected therewith, make it utterly improbable that any such enormous mass of sugar could come from that quarter to swamp the European market.

But France is also treated of, and in this connection we are told, that in Germany the average yield of sugar per hectare has amounted to 34·6 metric centners, whilst in France it has been 27·5.*

The conclusion is characteristic. Professor Paasche, after devoting ten columns to showing that Germany, as he says himself, is one of the best sugar-producing countries in the world, and demonstrating how and in what manner the position of Germany is a permanently leading one in the world's market, he says:—

"From what has been stated we might come to the conclusion that Germany can afford to dispense with bounties. But that is not the fact; we ought to leave the industry the small bounty which it has,

* Equivalent to about 27¼ cwts., and 21 3-5ths cwts., respectively.

in order that it may be able to lead a still more healthy existence than has hitherto been the case."

Now I call this a regular professorial conclusion. The only conclusion that could be drawn from the statements in question was this: away with the bounties, we have not the least need of them!

I shall not go further into detail respecting France; in the statement which I have brought in for distribution among the members of the Reichstag, the figures in which have up to now not been disputed, still less confuted, by anyone, everything that can be said on the sugar question with respect to the position of Germany as regards France has been set out in detail. According to those figures and statements Germany is so far in advance, in regard to the production of sugar, that if the premiums were abolished France would still produce her bounty-fed sugar at a greater cost, and consequently would bring it into the open market at a higher price than what we are in a position to do in Germany.

Dr. Witte then proceeded to deal with the question of allowing a period of 8, 5, or 3 years to elapse before the bounties were entirely done away with, and argued that the position of the German factories would be the same after any of these periods as now, and therefore economically unsound, and that not until the premiums were abolished would the prices in the open market be placed on a clear and sound basis, and, as he believed, with an upward tendency. And as regarded the figures adduced by Fürst Hatzfeldt showing that France, since 1887, had increased her production and export in a greater ratio than Germany, he showed that Germany could not possibly continue to advance at the same rate as was feasible in a country where the beet sugar industry had fallen so low as it had in France, but let them wait another five years, and the results would be totally different. To the further insinuation of Fürst Hatzfeldt, that the sugar which Germany placed on the London market was only a part of what was sold there, Dr. Witte replied: "Yes, but the fact, that Germany supplies 45 per cent. of the total quantity, of itself gives her, under any circumstances, the leading position."

Dr. Witte concluded by demanding an answer to his question what the German sugar industry would do in the interval accorded to it, and declared that if, as he believed, no other answer could be given than that it would do just as it is doing now,—be the term 8, 5, or 3 years,—then there was one reason more for the immediate abolition of

the premiums, to prevent the continuance of the unsound element which they had introduced into the national economy. He therefore appealed to the Reichstag to reject the clause which proposed to grant a fixed open premium for a limited term of years.

The *Journal des Fabricants de Sucre* has the following remarks as comment on the legislation adopted :—

"The scheme may be summed up as a combination based upon the strong position of the German industry, and directed towards increasing the revenue derived from the tax on sugar, whilst at the same time leading the rivals of Germany, by a roundabout way, to the end successfully pursued by the London Conference.

"It remains to be seen whether the countries which Germany has very nearly ruined by her exaggerated bounty-fed production will be in a position to dispense with their weapons, and to agree, without danger to their industries, to the pacific programme which it is sought to propose to them."

IMPROVED CRUSHING MACHINERY.

THE CYCLE MILL.

Referring to the notice of the Cycle Mill in our last issue, we have now the pleasure of placing before our readers an illustration shewing its application to an existing three-roll mill of the ordinary type. The conformation of its side frames or cheeks may be distinguished by the full lines on the lower part and the dotted lines springing from the upper end of the side caps, and running diagonally towards the housing of the bearings of the central driving roll. To this upper part of the framing is attached a plate iron superstructure for carrying the three upper rolls, secured to it by twelve bolts, as shewn. The plates enclose the upper part of the original framing, and form a rigid connection thereto. Across the upper part of the housing of the bearings of the driving roll, and rivetted to the superstructure between the plates, is a saddle which fixes it in its position. It is further connected with and secured by the two vertical through bolts, by the nuts shewn in dotted lines on either side of the housing of the bearings for the upper centre roll, under the uppermost closing cap. The lower ends of these bolts are not shewn, but are of the ordinary keyed ends. Situated centrally between the four upper rolls is an aperture of sufficient size to permit of the easy adjustment of the dumb returners,

CYCLE SUGAR CANE MILL.

SIDE CAP FRAMING.

PLATE IRON SUPERSTRUCTURE.

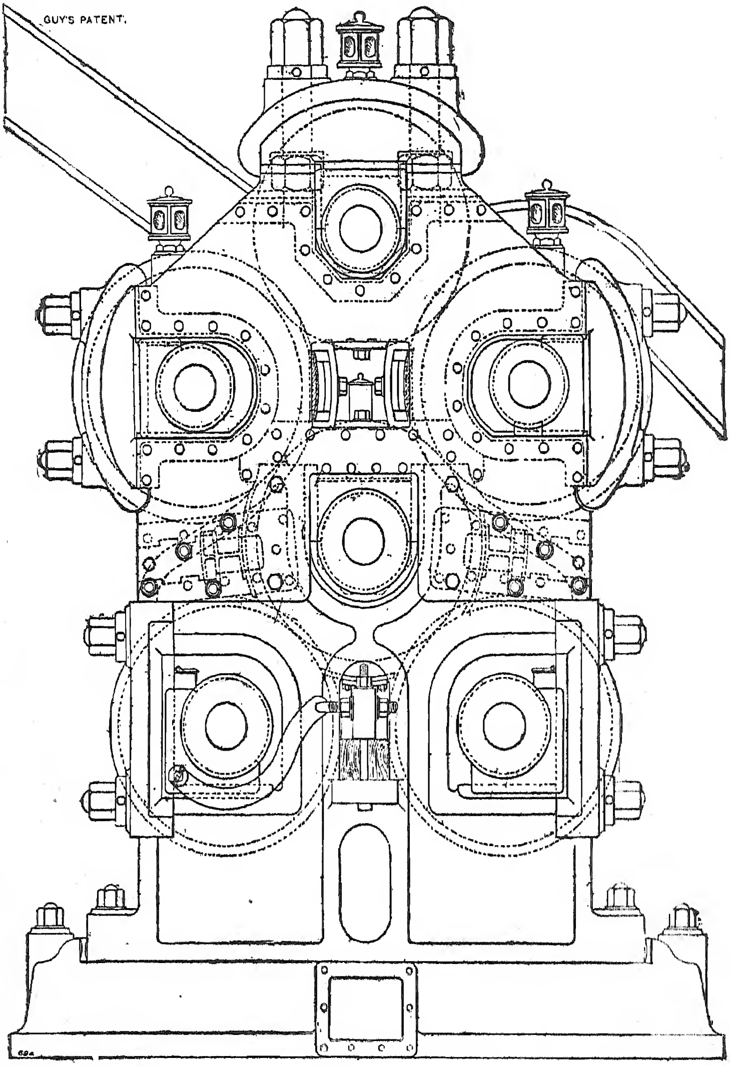
6 ROLLS, 6 CRUSHINGS.

SLANTING FEED.

GUY'S PATENT.

CLASS F.

RECONSTRUCTION.



which may be of any convenient form; those shewn are secured in their relative positions by bolts, and further interlocked by an upper and lower closing plate, likewise secured by bolts. The dumb returners on either side of the driving roll are sustained in pockets fixed on the inner side of the upper framing, and interlocked by closing plates toggled therein, which are secured by bolts to the framing. Provision is made for adjusting the turners to any desired position; this, however, could not well be shewn on such a small scale.

The canes are fed to the mill at the left-hand side, between the upper centre and upper side rolls, and pass between them downwards, between the upper left side and driving rolls, following the course downward between the lower left side and driving rolls, from thence between the lower right-hand side and driving rolls, and further upwards between the upper right side and driving rolls, through to and between the upper right side and upper centre rolls, whence they issue in a completely crushed state and pass down the shoot.

We may here state that other forms of upper framings or superstructures are made, and notably one in which the central driving roll may be placed in, or taken out, through a vertical opening in the framing, from the upper part to its housing in the original framing, suitable distance or filling pieces forming the lower part of the housings of the bearings of the uppermost roll, also the closing piece above the upper bearing of the driving roll.

In our next issue we hope to be able to further illustrate and describe the Cycle Mills, more specially with regard to a still greater number of pressings, and the "leaching" or washing out the remaining saccharine matter from the bagasse during its passage through the mill.

WHY DOES NOT INDIA PRODUCE HER OWN SUGAR?

We would call the attention of our readers to an article on the Madras Agricultural Department which has just appeared in the *Indian Agriculturist*, the greater portion of which we reproduce below. We quote this article at some length, not because the question of sugar production is in any way mentioned, but because it will assist very materially in answering the question which stands at the head of the present article. Dr. O. von Lippmann, in his interesting work on the "History of Sugar," (reviewed by us last year), shows that India was, in all probability, the original home of the sugar cane,

and the question why she cannot now supply at least the wants of her own population, instead of getting her refined sugars almost entirely from Mauritius, England, and even Austria and Germany, is one which immediately occurs to any one to whom the possibilities of the case are known. The causes have, of late, been tolerably fully discussed, and we have given prominence to them in several cases during the past year, see especially the articles under the heading of "Sugar Cultivation in India," on pages 516–518, and 537–539 of this journal, for October, 1890. But we think the reason why nothing has been done, and why things remain in *statu quo*, is to be found in the want of interest and action on the part of the various Agricultural Departments, and while strongly averse from undue interference with responsible officials, we believe that in the case before us, the creation of a strong healthy public opinion on this point, if such a thing be possible in India, is urgently needed. In one of the articles just referred to, we quoted a statement by Mr. C. B. Clarke, F.R.S., late of the Bengal Educational Department, to the effect that the idea, that the difficulty with the sugar cane industry in India is the limited rainfall, is not correct. He says: the "comparatively limited area in East Bengal with a moist climate," mentioned in paragraph 7 of the Government of India's letter, includes nearly all Bengal, from Calcutta to Dinagpore, and from Burdwan to Commilla, *an area enough to raise all the sugar used in the world.* Sugar cane can be grown anywhere in Bengal proper without irrigation.

The facts hitherto elicited seem, to people like ourselves, not on the spot, but who have to judge from what they hear from reliable sources,—to indicate that with proper attention and organization, and judicious help on the part of the responsible Governments, sugar ought to be made as largely remunerative an article of production as is opium at the present moment, and, besides supplying all the native requirements, ought to form as large an item of export as even cotton itself. Undoubtedly, the existence of such very small proprietorships renders effectual interference difficult, but the experience of several other sugar-growing countries would seem to show that a system of central factories, properly supported and controlled, would do much to change the present state of affairs.

We make no further apology for the quotation which we now give:—

"The Madras Presidency should, if appearances were not habitually deceitful, be looked upon with envy by every other province in India

in matters relating to the administration of its Agricultural Department. The late Governor of Madras acquired a reputation for not only taking an interest in agricultural matters, but also knowing a good deal about them.; and if he really did nothing else, he appointed the Madras Agricultural Commission, who have in their report supplied us with an inexhaustible mine of information on matters relating to agricultural improvement. To Lord Connemara has succeeded another nobleman, whose almost last work before he left England is especially referred to in the *Times*' review of the agricultural year at home. 'The most important announcement of the year,' it says, 'has just been made, namely, that a Department of Agriculture is to be added to the Yorkshire College, at Leeds.' In bringing this about Lord Wenlock was largely instrumental. The administration of the Agricultural Department in Madras should therefore present a marked contrast to that in other provinces, none of which have had of late so great advantages. When, however, we come to examine the reports of the Department there for the last two years, we are sadly disappointed with the actual facts. Madras, in fact, appears to have gone back almost entirely from the prominent position it held in the van of agricultural progress not many years ago, and to have been content to lie up in a kind of 'sleepy hollow,' under the influence of Sir E. Buck's grandiloquent but depressing resolutions. For this, of course, no blame can attach to Lord Wenlock, who has only just taken charge of his province, and we hope that a Governor with a home record like his may be able to put some life into his Agricultural Department. That this is necessary appears clearly from the reports just mentioned. These papers, which are issued in the form of 'resolutions' of that superannuated and discredited body, the Board of Revenue, consist for the most part of a bald *resumé* of petty matters of administration. In only one respect do they offer anything original and worthy of consideration. If all the rest were burnt or buried, the world would scarcely be the loser thereby. We miss in these reports the mass of suggestive and instructive matter that used to characterise the Madras agricultural reports when Mr. Robertson was at the head of affairs in that province. We find a reference in both to Mr. Benson's account of the Kurnool district, but that is passed over by the Government as devoid of practical utility, it is to be presumed, because it did not fulfil the requirements of the Government of India, although the Madras authorities are obliged to own

that they have been unable to understand what these requirements are. There is also a reference to similar work having been begun in the Cuddapah district; but, apparently, this most useful work has been abandoned, and Mr. Benson's energies have been perverted to the manufacture of a 'statistical atlas' (!) of the Presidency. Beyond this, and a preliminary enquiry into the growth of cotton in Tinnevelly, we do not find that anything is being done in Madras in the way of enquiry into native agricultural practices.

"In the matter of experimental enquiry, the reports are an even more melancholy record of retrogression. It may be said that, after a spell of some fifteen years of most valuable work in this direction, the Government of the Southern province has abandoned it. And why? Their own Agricultural Committee has shown the absolute necessity for such work, and the value of what has been done in the past; but the reports to which we are alluding show no possible reason for the abandonment of this most useful and necessary work. We trust that Lord Wenlock will see to this, and insist, during his term of office, on the recommendations of that Committee being fully carried out. In such work as this Mr. Benson's qualifications might be fully utilised, instead of being frittered away on secretarial duties and the compilation of statistical atlases,—which is perhaps deemed a convenient mode of suppressing unwelcome candour.

* * * * *

"To return to Madras. The record of the work of the Agricultural Department of that province of late years shows, in brief, retrogression, the abandonment of useful work, and a perversion of power to fanciful ends, but is relieved from complete inutility in that it has recognised in one branch of its work the necessity for further abandonment of work commenced. Everything there evidently now depends on the whole-heartedness with which the policy laid down by Lord Connemara in reviewing the report of his Agricultural Committee is carried out. That policy, if definitely adhered to, possesses the elements of useful work; but it yet remains to be seen whether anything more will come of its enunciation. That it is weighted with the incubus of the Board of Revenue, who are charged to carry it out, and who have from the earliest days of Mr. Robertson's efforts steadily opposed all progress, is not to our mind a fact that gives much room for hope that the results in the future will surpass those of the past. Lord Wenlock has a great opportunity before him, and we trust he may be able to

overcome the *vis inertiæ* of his subordinates, and set the work of the Department on a satisfactory footing. It would be a matter for infinite regret if we were to see the work, as set forth by the aforesaid Committee, delayed or in any way compromised by action dependent on the appointment, as it is rumoured there will be, of an agricultural chemist on the staff of the Government of India; for we are satisfied that the Madras Government possesses officers who are both able and willing to give effect to the policy referred to, and it only needs time and generous support of their labours to allow of valuable results being obtained."

RESULTS OF WORKING AT PLANTATION MEERZORG, (SURINAM).

The results given below are communicated by Mr. J. S. Blake, and have been obtained on the above plantation in Dutch Guiana, which is fitted up with a small set of works supplied by Messrs. D. Stewart & Co., of Glasgow, and the machinery appears to be doing excellent work.

The mill is a small three roller, 22 by 36, with returner, and the crushing must be considered as exceedingly good for such a small sized mill. All the exhaust steam from the engine goes direct to a boiler, 8 by 5, fitted with brass tubes 4 in. diameter, through which pass the heated gases from the boilers to the chimney. The steam for all the evaporating is taken from this boiler or heater, in a very dry condition and does very effective work. The system has been in operation for some years on the Claudio, Rio Branco, Rio Fundo, and Iguape Central Factories, in Brazil, and is now being introduced in Java.

Report.

On our last grinding of 46½ acres, we made 140 tons of sugar.

The juice averaged 9·5 Baumé; gallons per ton, 1732.

Extraction on indicated polarization, 84%.

Crushing, tried by repeated experiments, averaged 75% with 24 cwt. on hydraulic, and with soft canes was as high as 78·5%.

Extraction from weight of cane, 9·4% of *pure* sugar, *i.e.*, reducing 1st and 2nd sugar to 100° polarization.

The steam enters superheater at a pressure of 15 lbs. or 250° Fahr., and leaves for the pan under the same pressure at 330° Fahr., a gain of 80° Fahr., or 32% gain over saturated steam.

THE AMERICAN BEET SUGAR INDUSTRY.

It will be remembered that some few months ago Professor Wiley published, under the authority of the United States Department of Agriculture, a very interesting pamphlet (to which we called attention) giving a full account of the beet sugar industry in Europe, and laying special stress upon the large tract of land in North America on which it would be possible, judging by the climatic conditions, to successfully raise beets for sugar manufacture. This, together with the bounty granted under the McKinley Bill to home-made sugar, is having natural results in the various efforts to induce a trial with beet growing in several parts of the States. The matter has not failed to attract attention in other sugar-producing countries, and has been alluded to in the discussion on the new Sugar Duties Bill in the German Reichstag. The sugar question has, of late years, assumed a totally different position from that which it once occupied, and at the present moment no one interested in any way in the production or sale of cane sugar can venture to neglect the facts connected with the development of the beet. We think, therefore, that the following extract from the New York *Merchants' Review* will be useful as a help to forming a sound estimate of what is going on in this direction in America, respecting which many exaggerated statements have been made by parties interested in promoting special views, or not sufficiently posted up in the facts to enable them to form just conclusions:—

We find in a number of our trade exchanges, especially those strongly tinged with protectionism, a disposition to take a very sanguine view of the outlook for the domestic beet sugar industry now that the McKinley Tariff has gone into effect and the date fixed for the payment of a bounty is close at hand. Experiments with the growing of sugar beets, and the industry has hardly passed the experimental stage, are not by any means novel. As far back as 1830 beetroot sugar was produced in this country, but only a few hundred pounds were manufactured in that year. During the succeeding years, until 1890, no greater quantity than 2,600 tons was produced in any single year (in 1889) until the last twelve months of the period, when the production is estimated to have increased to 10,000 tons. In 1888 only 1,910 tons of beet sugar were manufactured. The material increase of the production in the last year of the period was undoubtedly due to the State bounties and the bonuses offered by local communities to the three factories in operation during the past year. Now, it is quite plain that if the American

people are to make sufficient progress in developing the domestic beet sugar production to be able to supply a decent percentage of the total quantity of sugar annually consumed by them, during the term of years in which the national bounty will operate, no time must be lost in setting about the work. This country consumes annually one and a half million tons of sugar, and it begins the experiment of raising its own supply of beet sugar, under the bounty regime, with an annual yield of only 10,000 tons—a mere bagatelle and just about the quantity that France produced in 1832; in 1890 the total production of France, under the stimulus of generous bounties and careful fostering of the sugar industry by the Government, amounted to 770,000 tons. If, therefore, we meet with a success equal to that of the French, we must wait for fifty years before we can produce one-half of the sugar that we consume annually. But it may be taken for granted that a greater degree of energy and skill will be displayed by Americans when once they take hold seriously of the problem of producing sufficient sugar to supply domestic wants, and that where the European nations advanced by inches we shall progress by feet and yards—provided, of course, that the bounty system is maintained and the farmers find beetroot growing more profitable than raising breadstuffs. The farmers, however, have yet to pass the experimental stage, for hitherto all previous attempts to produce beet sugar in this country at a profit have been, with two or three exceptions, financial failures.

According to Chemist Kedzie, of the Michigan Experimental Station, there were a number of reasons for these failures, of which he mentions two of the most important, viz.:—

1. The machinery for a sugar plant is very costly—can be used only a few months in the year—and requires great technical skill to run it profitably.

2. A very large amount of beets must be furnished to stock and run a factory, of good quality and at a price that manufacturers can afford to pay. A successful sugar plant should have 50,000 tons of beets, containing 12 per cent. of sugar, and for such beets the manufacturer can afford to pay $3 per ton delivered at the factory, with an increase of 25 cents for each per cent. above twelve. This would take 3,500 acres of land in beet culture each year, or 7,000 acres for a rotation, because beets cannot be raised continuously on any soil. The beet raising area must be so near the factory that the cost of hauling the beets to the factory shall not eat up the profit.

In view of the fact that the possibility of adding a new and important industry to the State is agitating the minds of Michigan farmers and manufacturers, Mr. Kedzie calls attention to the necessity of satisfactorily settling

certain questions which he propounds, before any effort is made to build and equip sugar factories in the State. He says:—

1. Given a climate and soil adapted to the growth of sugar beets in such quantities that they can sell the beets *(with reasonable profit to themselves)* to the manufacturers at a price they can afford to pay and make a reasonable profit in making sugar? If the farmers lose money in raising beets, the supply for the factory will surely fail, and the factory close for want of raw material. This is the first question to be settled, and until it is settled all projects for making beet sugar are a delusion and a snare. This is a question for the farmers to settle first of all—how many tons can be raised per acre? how much does it cost per ton? They can get at *the root* of the whole matter by *raising the roots.* This is the problem to be solved in Michigan; *it is still the unsolved problem for Nebraska.*

The second question is—What is the value of beets raised in Michigan for making sugar?

These questions can be satisfactorily answered only by actual trial. No guess or estimate or figuring what the yield ought to be can give the reliable data upon which to base business matters involving so large an outlay of capital. A quarter of a million dollars should not be invested on guesswork. But if fifty or sixty thorough-going farmers in different sections of the State will give the subject a careful trial to determine how many tons of beets fitted for the factory can be raised on an acre, and what is the actual cost per ton of raising the beets, and if fair specimens of such beets shall be sent to this experiment station for analysis to determine the amount of sugar they contain, such investigations will furnish the bottom facts of the beet sugar industry in Michigan.

In order to afford the farmers every opportunity to successfully carry out the proposed experiments, the Experiment Station will supply them with four of the best varieties of seed procured from Europe, with full and clear directions for planting it and cultivating the roots. The farmers, on their side, are to follow instructions implicitly, keeping an exact account of the cost of raising the crop, and weighing the mercantile crop or the beets free from tops and the crown that rises above the ground.

By these means it will be known by this time next year whether Michigan farmers can profitably cultivate the sugar beet, and the sugar factories manufacture sugar from it successfully. The results in that State will doubtless afford an inkling of the prospects in other sections of the country, but until fully a twelve month has elapsed, it will be ridiculous to indulge in sanguine expectations of an early and rapid development of the domestic beet sugar production.

UNITED STATES.

Laws in Regard to Sugar.

Continued from page 263.

Bonds.

A bond must be executed by every person or firm intending to manufacture and produce sugar under the bounty provisions of said Act prior to July first of each year, on the prescribed form (No. 278), which must accompany the notice and application for a license. The bond will be executed in accordance with the instructions printed on the form.

Collectors will, in addition to a careful examination of the sufficiency of all sureties offered, require the sureties to justify on Form 33, in amounts which, in the aggregate, should not be less than the penal sum of the bond.

These bonds, after the sufficiency of the sureties has been certified by the collector of the district, must be transmitted to the Commissioner of Internal Revenue for approval. The affidavits of the sureties on Form 33 will be filed with the bonds.

Individual sureties must reside in the same collection district with the principal, except in cases where the collector is otherwise specially instructed.

The collector is to be the judge of the sufficiency of the sureties. If a guarantee company, authorised by law to become surety on bonds and undertakings, should be tendered as one of the sureties on a sugar producer's bond, the collector can accept the same if the company is within the jurisdiction of the United States Court of the district in which the collector's office is located, or has a resident agent there, duly authorized to accept service, or upon whom service may be made in case of suit, and has money or property subject to execution or process sufficient in amount to meet all probable demands upon it.

A copy of the charter and by-laws of such company, if accepted as a surety, should be filed in the office of the Commissioner.

The penal sum of the bond will be fixed by the Collector of Internal Revenue, and will be equal to at least one-half the bounty on the amount of sugar proposed to be produced during the year, reckoned at two cents per pound, but will not in any case be less than $200.

If in any case the collector is of the opinion that the location of the

factory is such as would enable the producer to defraud the Government he will report the facts to the Commissioner of Internal Revenue in forwarding the bond, and in such cases approval will be withheld until all required conditions are satisfactory.

A new bond will be required in case of the death or insolvency of the sureties, or in any other contingency, at the discretion of the Commissioner of Internal Revenue.

Collectors will report whenever in their opinion a contingency arises which renders it proper that a new bond should be required to protect the interests of the Government.

The collector will keep a record in his office which will show the date of the bond, the penal sum, the name and residence of the sureties, the date when the bond was received by him, and the date when forwarded to the Commissioner.

License.

Upon receipt of the notice and application for license and the bond, if the same upon examination are in due form and approved by the Commissioner, a license will be issued without charge through the Collector of Internal Revenue, which must be kept conspicuously displayed in the place or establishment where the sugar is produced.

The licenses will be numbered consecutively in each district, commencing with No. 1, and each factory will be designated by the same number.

There is no provision in the law for transferring a license.

Operations must begin under the first license given under the law, with no molasses, syrup, or sugar on hand from the previous season.

All sugar or material for making sugar from the previous season should be removed, or the manufacture thereof should be completed and the product removed from the factory before operations are commenced under the license.

The law provides that no bounty shall be paid to any person engaged in refining sugars which have been imported into the United States or produced in the United States upon which the bounty has already been paid or applied for, nor to any person unless he shall have first been licensed, and only upon sugar produced by such person from sorghum, beets, or sugar cane grown within the United States, or from maple sap produced within the United States.

If a planter or farmer sells the cane which he has raised, or the syrup which he has produced, at any period before the manufacture

of sugar is completed, he will have no right to the bounty on the completed product.

There is no bounty on syrup which is not made into sugar.

Sugar, to be entitled to the bounty, must be made from the cane or other raw materials after July 1st, 1891. No wagon sugars remaining over from the previous season's production, or sugar in process of manufacture made from cane or syrup before July 1st, 1891, will be entitled to the bounty, although the process is completed and the sugar made after July 1st.

Polariscopic Test.

It will be necessary under the law to classify the sugar for payment of the bounty according to the polariscopic test.

The polariscope is an instrument which determines the per cent. of pure sugar in any given sample, without regard to its colour or condition. The sample of sugar to be tested is carefully weighed and dissolved in an exact volume of water, and a ray of polarized light is passed through the solution. In passing through the solution the ray is deviated in proportion to the amount of pure sugar which the solution contains. This instrument measures the deviation of the ray upon a scale of one hundred degrees.

When sugar tests ninety degrees, it is nine-tenths pure sugar. There will be no bounty upon any sugar which does not contain eighty per cent. of sucrose or pure sugar.

Upon sugar testing 80 to 90 degrees by the polariscope, the bounty will be $1\frac{3}{4}$ cents per pound, and upon sugar testing 90 degrees and above, 2 cents per pound.

Payment of the Bounty.

An annual appropriation is not required for the payment of the bounty. The act carries an appropriation with it, that is, makes what is called a permanent annual appropriation.

Section 3689 of the Revised Statutes under which the bounty is to be paid includes items which are payable when the liability accrues, out of any money in the Treasury not otherwise appropriated, and for which a specific appropriation is not required.

The law provides that for the payment of these bounties the Secretary of the Treasury is authorized to draw warrants on the Treasurer of the United States for such sums as shall be necessary, which sums shall be certified to him by the Commissioner of Internal Revenue, by whom the bounties shall be disbursed.

Each individual who claims the bounty will make his application to the Commissioner on the prescribed form through the collector of the district, who after examining the same and certifying to its correctness, will transmit it to this office, where it will be examined and forwarded to the proper accounting officers of the Treasury to take the usual course of claims against the Government. After the claims shall have been allowed, drafts upon the Treasury will be issued in payment, which will be mailed or delivered to the persons entitled thereto.

Claims for bounty cannot be transferred or assigned. Such assignments are prohibited by Section 3477, United States Revised Statutes. The claims must be made by the sugar producer, and the drafts issued in payment of the claims will be made payable to his order.

Additional Regulations.

The law further provides that "the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall from time to time make all needful rules and regulations for the manufacture of sugar from sorghum, beets, or sugar-cane grown within the Unted States, or from maple sap produced within the United States, and shall, under the direction of the Secretary of the Treasury, exercise supervision and inspection of the manufacture thereof."

Instructions relative to the books which will be required to be kept by sugar producers, the manner of making returns, the supervision of the factories, the weighing and inspection of the sugar, and the form of making application for bounty, etc., will be issued in due time.

Regulations in regard to the use of alcohol free of tax for making sugar from sorghum are in course of preparation to be known as Series 7, No. 7, Revised, Supplement No. 1.

Blank Forms.

The proper blank forms referred to in these instructions will be furnished to Collectors of Internal Revenue, and persons intending to manufacture sugar and apply for the bounty will be able to obtain the same upon application to those officers.

JOHN W. MASON, Commissioner.

Approved: A. B. NETTLETON,
Acting Secretary of the Treasury.

Appendix.

The form of the sugar producer's bond will be substantially as follows:—

Form 278.—United States Internal Revenue.

Sugar Producer's Bond.

(This bond must be executed by every person or firm intending to manufacture sugar under the bounty provisions of the Act of October 1st, 1890, prior to July 1st of each year, and should be accompanied by affidavits of sureties on Form 33.

This bond, after the sufficiency of the sureties has been certified by the Internal Revenue Collector of the district, must be transmitted to the Commissioner of Internal Revenue for approval.)

Know all men by these presents:

That we,.......... of ....as principal , and .... of .... of ....as sureties, are held and firmly bound unto the United States of America in the full and just sum of ....dollars, lawful money of the United States; to which payment, well and truly to be made, we jointly and severally bind ourselves, our heirs, executors, and administrators firmly by these presents.

Sealed with our seals and dated this......day of......, A.D. 189 .

The condition of the foregoing obligation is such, that, whereas the said..........intend to engage in the manufacture and production of sugar from sorghum, beets, or sugar cane grown within the United States, or from maple sap produced within the United States, during the next ensuing year commencing July 1st, 189 , at............in the.......... of .... and State of .... ; and whereas, said..........desire to secure the payment of the bounty authorized and provided for in the Act of Congress, approved October 1st, 1890, entitled "An Act to reduce the revenue and equalize duties on imports and for other purposes;" and whereas, said.......... has filed with the Commissioner of Internal Revenue the notice required by said Act, and an application for a license to produce and manufacture sugar at said place and within said period of time in accordance with the provisions of said Act of Congress:

Now, therefore, if said..........shall faithfully observe all the rules and regulations prescribed by the Commissioner of Internal Revenue, and approved by the Secretary of the Treasury, for the

manufacture and production of sugar, then this obligation shall be void; otherwise, it shall remain in full force and effect.

Signed, sealed, and delivered in presence of—

............................[L. S.]

....

............................[L. S.]

....

............................[L. S.]

State of.................. }
ss:
.... }

I hereby certify that on this..........day of .... one thousand eight hundred and ninety-......, before me personally came ...., known to me to be the individuals described in and who executed the within bond, and severally acknowledged that they executed the same.

....

Instructions.

The following instructions must be particularly observed and complied with, viz.:—

1st. The Christian names must be written in the body of the bond in full, and so signed to the bond.

2nd. The residence of each signer must be stated in the bond.

3rd. A seal of wax or wafer should be attached to each signature.

4th. Each signature must be made in the presence of two witnesses, who must sign their names as such, and the execution of the bond must be acknowledged by the principal and sureties before some officer authorized by law to take the acknowledgment of deeds, or before the collector of the district or one of his deputies.

5th. There must be two or more sureties, and the bond must be dated.

6th. In the case of a firm the name of each person constituting the firm, as well as the style of the firm, should be stated in the beginning of the bond, as for instance, "John Doe and Richard Doe, doing business as Doe & Co.," and the bond must be signed by each member of the firm.

In the case of a corporation, the full corporate name and that the corporation has been duly organized under the laws of the State must be shown in the beginning, and the bond must be signed with the corporate name, and with the name and title of the officer duly

authorized to sign for the company, by the by-laws, or by resolution at some meeting of the company or the directors, a copy of which resolution or by-law shall accompany the bond. The signature of the person signing for the Company shall be authenticated by the Corporate Seal.

The penal sum of the bond must be fixed by the collector, and should be at least one-half the amount of bounty on the quantity of sugar proposed to be produced during the year, reckoned at 2 cents per pound, and must not in any case be less than $200. When the bond is found to be properly filled up and the sureties ample, the collector will indorse his certificate thereon, and forward the same to the Commissioner of Internal Revenue for approval.

THE HUGHES DIFFUSION BATTERY.

Report of Working during Season of 1890.

The following is the report of the General Manager of the Hughes Sugar House (Louisiana), on the machines and processes in use during the past season.

The hydraulic crane for transferring the cane from the waggons to the carrier. The time required to make a transfer, including the hooking on, is, for thirteen records, eighteen seconds. The proper length of the becketed sling is five and one-half feet. Twelve such slings hold about one ton.

When the sling is removed, the bundle is adjusted on the carrier, partly by gravity, and partly by hand; but, when the seed is removed automatically, there is nothing to be gained by arranging the cane for regular feed, and this expense is saved.

It is practicable to unload one ton in three and one-half minutes. Seventeen tons an hour is the capacity of the hydraulic crane; one man on crane and the driver are all the hands required, thus dispensing with the gangs of men unloading, storing cane and placing cane on carrier, and arranging feed, besides saving the cane broken and trampled and made worthless.

From these causes alone, the loss last season amounted to more than eight per cent. of the crop. This year the loss was not appreciable. The record does not allow for time occupied by change of teams.

The cleaning of the cane by our patent process, and the automatic seed topping have been long since sufficiently demonstrated, and there is nothing new to report.

There are many variations of machines in use elsewhere, all of which are infringements on the process patents.

The elevation and transfer of the clean section cuts was successfully accomplished by a belt carrier with laggings riveted on belt.

A bin, of sufficient capacity for storing cuts for the night was in use, and it was found to work well, when section cuts were not stored more than twenty-four hours; and kept better than canes stored in bulk.

The bin should be divided into two sections in order that the old cuts should not be mixed with the new. The storing of comminuted cuts proved to be impracticable, owing to the difficulty in separating the mass and the rapid deterioration.

Comminuting and Double Comminuting Apparatus.

This consisted of two machines; first, one of bronze, and second, below this two of iron. This is referred to in our patents as double shredding. The knives of the upper cylinder have to be set out sufficiently to strike the section cuts, and the lower cylinder had the knives set in much finer, according to size of chips required.

One hundred revolutions on the engine gives sufficient capacity for 60 tons of field cane with the present cramped feeding arrangements. At 130 revolutions overfeed was impossible under these conditions.

The minimum speed of comminutors should not fall under 2500 revolutions when shredding. Clean canes shred easier. Sharp knives with keen edges are absolutely necessary.

The cylinders should be fed with a carrier, insuring a uniform feed over the whole width of knife, and not from a bin directly as in the present arrangement.

Cylinders and cutting bars should be bronze.

The patent for double shredding has been allowed.

Automatic Packing and Feeding Baskets and Turn-tables.

The notes show that this machine should be uniform in its movements, and be independent of other influences. In order to secure the densest juice, 35 to 38lbs. to the cubic foot must be packed in each basket. By causing the baskets to revolve on a turn-table, and

pounding at a stationary point with a hammer head, the diameter of said hammer being such that it does not reach to the centre, a series of rings are formed, which, as the basket fills, gradually develop into a tube of comminuted cane, through which the juice passes in and out freely; thus solving the problem satisfactorily of extraction in the centre of the baskets, and warranting the construction of the largest size batteries. During the last three weeks, this machinery was in use successfully day and night, having gradually grown to a practical machine.

This apparatus is a great acquisition to the company; and, besides saving labour, makes accurate work in the battery, and regulates the density of the juice. The perfect control secured by this arrangement has no parallel in German batteries.

The Battery.

The double shredding has enabled our battery to secure good extraction throughout the season.

The period of time necessary for diffusion, or washing out the sugar, as the case may be, is limited by the size of the chips in width. This has long been known to me, but until double shredding was invented, the method was impracticable.

I would now suggest that the name of our battery be changed to the Instantaneous Percolating Diffusion Battery.

A final trial, to test this theory, was made on November 11th. Eighteen baskets were run on fifteen seconds immersion, and the juice from the exhausted chips contained in one case ninety one-hundredths of one per cent. only, and another eight-two one-hundredths of one per cent. This movement permits to be taken off fifty-seven baskets in one hour of 324lbs. net, equaling 18,468lbs., or in twenty-two hours, 406,296lbs. of clean chips, being over 200 tons per day.

The crane can rise in seven seconds, turn in six, and fall in seven; twenty seconds for one operation. Cells can be filled and discharged while cane is working.

This quick working would require an additional crane for dumping the bagasse, two eleventh cells, and a water pipe with three times the present capacity. The present size heating pipes in the cells are thought to be sufficient, if the hot water supply tank and the eleventh cells are kept hot.

The turn-table, between eleventh cell and battery, should be circular, and eighteen baskets should be the complement for the battery. Plans for the changes are in note-book.

The density of the juice when the baskets are properly packed, often approximated the mill juice very closely, while the extraction throughout the season varied from 86 to 96%, including all experimental work.

The mechanical device for the removal of the lids of the baskets was a perfect success, and settles that point conclusively.

The accusation that the juice from the battery was spoiled and discoloured by the iron, was totally disproved.

The action of acid juices on the iron is prevented by painting the exposed surfaces. Should iron be present in the juice from any cause, its effects are beneficial in the presence of lime, and a process has been patented for clarifying saccharine liquids by using lime and hydrate of iron.

The action of air on the draining juice, from which vapour is rising, has previously been shown to be a sufficient preventive against inversion.

The results obtained fully confirm the theories given in Bulletin No. 26, p. 17, Department of Agriculture, as follows:—

"There is one condition, however, in which I see a possibility of usefulness for the Hughes system of diffusion. There are two considerations which are kept in view in the extraction of sugar, viz.: (1) the completeness of the extraction, and (2) the density of the extracted juice. Theoretically the density of the diffusion juice can be made equal to that of the juice in the cane by an infinite number of cells in the battery, or an infinite number of dips in the Hughes apparatus.

At first in starting a battery the hot water is speedily charged with the solids in solution in the cane cells, being brought into direct contact with the normal chips. In the regular running of a (foreign) diffusion battery, quite a different condition obtains. The extracted juice is brought only once into contact with fresh chips. We may regard normal diffusion as such a conduct of the work as allows complete equilibrium to be established between the circumfluent and intercellular juices, which in each case are equal in volume. The

rate of diffusion depends, as is well known, on the size of the chips and the temperature of the juice. The smaller the chip and the higher the rise of the temperature, the more speedily will this equilibrium be established.

The size of the chip, however, has more influence on this operation than the temperature. The theoretical normal diffusion would take place in a single cell surrounded by the diffusion juice. The superposition of cells such as is found in the ordinary cane chips and beet slicings entering the battery requires that the diffusion should take place in the exterior layer of cells and from one direction before it can begin with the interior layer. The time required for the diffusion through a single cell-wall, containing within a solution of sugar, is not instantaneous, but extremely minute. But the sum of the intervals required for the penetration of hundreds of cells successfully becomes quite large.

In a normal diffusion of twelve contacts or twelve dips, the relative concentration of the diffusion juice compared with the original juice in the cells of the plants can be calculated from the formula given in Bulletin No. 2, page 10. In practice, however, a larger quantity of liquid is used than in normal diffusion, and the time of contact is not long enough in each case to secure complete equilibrium.

With the (foreign) apparatus now in use, therefore, we cannot hope to obtain a relative density between diffusion and normal juice of more than eighty to one hundred. Any proposition looking to the procuring of normal diffusion juice by allowing the time of contact to be extended beyond reasonable economic limits must be rejected for practical reasons.

By reducing the size of the diffusion chips, the normal diffusion juice can be more readily obtained. In the case of the beet, by reducing it to a fine pulp the normal juice, i.e., complete equilibrium is obtained in so short a time as to be practically instantaneous. On this fact Pellet has based his process for the instantaneous analyses of the beet by the aqueous method. No rise of temperature is required for this purpose, the equilibrium being established almost instantly in the cold.

Sugar canes, both sorghum and sugar cane, reduced to a fine pulp would act in the same way. The mechanical difficulties of doing this are much greater than in the case of the beet, on account of their more fibrous structure.

Nevertheless, a cane shredder might be constructed which would furnish a pulp approximating in fineness the beet pulp above mentioned. In applying such a process practically, however, a point might be reached in the ordinary battery where the fineness of the chip would impede and finally prevent the circulation. This would arise from the fact that the pressure in such a battery is always in the same direction, save in the first filling of the cells. The almost solid pulp thus formed might be more or less impervious to the circulation of the diffusion liquids. Now, if such a fine pulp can be produced in an economical way, it might be worked to great advantage in the Hughes Battery.

In dipping the basket into the cell of liquid, the pulp would be raised and loosened, and the perfect mixture of the pulp and liquid would be at once secure.

The diffusion would take place almost instantly, the basket could be quickly removed, and a small battery be made to do a great deal of work. In such a case I can easily see how a Hughes Battery might be made to operate in a successful manner. The fact that such a diffusion could be carried on at ordinary temperature would allow a purer juice to be obtained, since at high temperatures starch is rendered pasty, and pectic substances rendered soluble.

It seems to me the above record revolutionizes the cane sugar business, and the cost of a mill or a foreign diffusion battery is far greater than our battery. The foreign battery is slow in its work, and dilutes the juice as 80 is to 100, this being its best possible theoretical work.

The clarifying in the baskets with lime salts, filtering through fine wires, and the juice passing through sawdust, gives satisfactory results.

I recognize that this season has brought to a sufficiently practical point the costly experiments now extending through eleven years, and that there is no reason for a further outlay for experimental work.

The machines are mechanically very fine, and the chemical record is satisfactory.

It now remains for the machines to be manufactured and put to work on beets, cane, and other industries.

THE SEREH CANE DISEASE.

By Dr. G. Kottmann, Inspecting Chemist of the Colonial Sugar Refining Company.

The disease of the cane called sereh is known to have existed in Java for only a few years. It is said by some that it was first discovered in 1879 in the Cheribon district in Western Java, while others contend that it was recognised as a well-defined disease only in 1883 in the same district. Possibly its real origin has to be dated back further even than 1879, as it is a disease which in its first stages does not develop any very marked outward signs, and so may have only had attention drawn to its existence when it had taken hold of the cane to such an extent that the crops fell off considerably.

The outward signs of the sereh are side-shoots springing from the cane, and a tendency to the formation of roots on the stalk, and also to the development of more leaf than stalk. The latter is the most characteristic of all signs. When the cane gets very badly diseased the leaves are set much closer together than is the case with sound cane, and in the last stage of the disease the cane forms almost nothing but leaves and no stalk; the stool then has much the appearance of a herbage known in Java as sereh. Thus the disease got its name. Other characteristics are red streaks in the interior of the cane on being split open, the cane becoming rapidly over-ripe, and the dry leaves being more brittle than those of sound cane. When the sereh has fairly got hold of the cane, the crops fall off considerably, and the ratoons as well as the fields planted with diseased cane show, as a rule, a still more serious decrease in the yield.

It is not at all an easy matter to decide in the early stages as to whether cane is attacked by sereh or not. The disease begins to show itself by outward indications only after the cane is well over ground. But even then stalks infected with the disease may attain nearly normal development.

In order to illustrate the difficulties in the way of discerning sound and diseased cane, I may mention that Mr. Kobus, the botanist of the Eastern Java trial station, who has repeatedly travelled over the sugar districts of Java under special instructions to collect information on the disease, and who should therefore be well acquainted with its outward signs, says in the July number, 1890, of the Java agricultural paper *De Landbouwer*:—"With our want of knowledge as to

the nature of the sereh, and of distinct outward signs of the disease, it was sometimes difficult to say if a plant was attacked by sereh or not." Dr. Benecke, the head of the trial station of Middle Java, in the November number, 1890, of the same paper, is reported to have said, when asked about the cane obtained in a certain experiment, that he would not give an opinion on the question as to whether the cane was healthy or diseased, as neither the cause nor the symptoms of the sereh are yet known.

I may remark that if a cane develops some of the exterior indications of the first stages of the sereh disease, as for instance the growth of many side shoots or red streaks in the cane, it is not proved thereby that the cane is attacked by the sereh, as cane interfered with in its development in different ways may show the same signs. If, however, cane were to develop many side shoots and closely set leaves at the expense of the formation of stalk, and some of the stools were to assume the appearance of bushes of pampas grass, and if also the plants taken from such cane as well as the ratoons grown therefrom were to exhibit signs of the disease in a still more pronounced manner, it might be said with some reason that the cane was attacked by sereh or a disease very similar to it.

The following observations may contribute to our acquiring some understanding of the nature of the disease:—Cane afflicted with sereh is especially found close to the irrigation ditches. The Cheribon district, where the disease was first discovered, consists largely of low-lying land. Fields on elevated land have been found to be less subject to disease than low-lying fields under otherwise similar conditions. The treatment of the soil with lime seems to favour the disease, while the application of acid bodies—acid fermented molasses, acid manures, &c.,—seems to check it. These observations, however, require corroboration. Late planting towards the end of the dry season seems to favour the disease; early planting not long after the beginning of the dry season appears to retard its progress. Cuttings taken from the very top of the cane give much less diseased cane than do those from the main stalk. The weakest stools exhibit the signs of disease first. Cane much attacked by borers or other insects is rendered more liable to disease than cane not so afflicted. Cane sick with sereh is much more attacked by parasites than sound cane. It is believed by many that the germs of disease are carried by the air.

There is nearly unanimity of opinion with regard to the infectious

character of the disease. Not only experiments, but also the way in which the disease has spread, support this opinion. From the western district of Cheribon the disease has slowly advanced with almost wave-like front towards the east; and whereas in 1888 only Western and Middle Java were infected, the canefields of also Eastern Java are now attacked. The damage done by the sereh in some parts is very great; districts have been known where the sereh has reduced the crop by 30 per cent., which means a much greater loss for those mills which suffered chiefly. It is reported that in some cases even only 25 per cent. of the ordinary crop was obtained from sereh-infected fields.

That the Java planters have been very eager in their endeavours to find a remedy against the sereh is easily understood. But so far they have not been very successful. A few years ago great hopes were set upon the introduction of new varieties from other countries, especially as regards a certain variety found in Borneo, and fabulous sums were spent for the purpose. The Borneo cane at first showed very vigorous growth, but in the 1890 season it suffered in many places, even more than the old varieties. It is said in explanation that the commencement of the wet season was unusually dry for that year's cane, and that the Borneo cane is very sensitive to want of moisture. This would support the theory of the disease being favoured by conditions of weakening influence on the growth. Nevertheless the belief in new varieties from other countries seems to be yet very strong, as it was reported quite lately that it was intended to procure a large supply of plants from India.

Amongst the other remedies for the sereh which have been tried with more or less partial success are the disinfection of the fields with sulphate of iron, sulphate of copper, or naphthaline; the heating of the land with fermented molasses, which had been allowed to get sour; the steeping of the cuttings after splitting and drying in thin solutions of carbolic acid, sulphate of copper, chloride of mercury, and other disinfecting agents; also, last but not least, the application of artificial and organic manures—stable manure, compost, &c.,—with or without a thorough improvement of the cultivation all round. The disinfection of the fields with sulphate of iron and copper sulphate has resulted in considerable success in some cases, and the steeping of the cuttings is also reported on favourably by some, though disparagingly by others, but it seems that none of these means come up to artificial manuring combined with improved cul-

tivation all round. In fact, the opinion already alluded to seems now to gain ground that the sereh is favoured by influences which are adverse to a healthy development of the cane, and that provided the cane is planted in well-prepared soil, carefully treated and well manured with artificial and organic manures, and that the importance of a wise change of plants is not forgotten, the disease may be held at bay.

Dr. Trenbuer, the director of the renowned botanical gardens of Buitenzorg, and Dr. Ostermann, a cane planter, of Middle Java, have from plants obtained from much-diseased cane, got cane which was sound to all appearances and of vigorous growth. In Dr. Ostermann's case the explanation is added that first-class soil was chosen for the experiment, and that the soil was turned over by the spade to a great depth, liberally manured with stable manure, and well cultivated. From one of the cuttings of badly diseased cane he obtained in this experiment twelve stalks, weighing 59 lbs.

That Mr. Lucas, planter, of Tegal, reports a diminution for 1890 of the damages done by sereh in his district is also a very important statement, and perhaps stands in some relation to improved cultivation.

It may sound paradoxical to any one who knows of cane cultivation in Australia and in Java, to speak in these colonies of the importance of improvements in the cultivation of the latter country. The care taken there in the canefields is extreme as compared with the care bestowed on the cane in Australia. The laying-out of the fields, the selection of the plants, the planting and the weeding, are all carried out to perfection, and no cane is grown without irrigation, and scarcely any without some manuring. Yet there are still great defects in the cultivation. The fields are planted with cane immediately after the preceding crop is taken off. This crop, in most cases, is flood rice, for the cultivation of which the fields are for a long time under water. The easy means of getting water for irrigation may also often be the reason for using an excess of it during the cultivation of the cane. The land is prepared by the plough only in exceptional cases, and as a rule not more than part of it, say about a half or less of the whole area, is turned over by the spade, with the Reynoso system in vogue, though the working of the soil is done to a great depth in the plant furrows. The soil is systematically impoverished

in organic matter, as nightsoil or stable manure is seldom used, and the trash is burnt in the mill.

What may be the exact nature of the disease is a mystery yet, though this question has been the subject of study for a number of years by a great number of scientific men resident in Java, and partly engaged by the sugar manufacturers for that special purpose.

Dr. Krüger, who for several years held the position of head of the trial station of Western Java, is confident that the disease is caused by bacteria which have not yet been discovered.

Dr. Soltwedel, the head of the trial station of Middle Java, now deceased, had the firm belief that similar parasites to those causing disease in the beet, and living upon the roots of the cane, are the cause of the sereh. These parasites are called nematodes.

It seems that both these theories have a good many partisans. It is contended by the followers of Dr. Krüger that though nematodes have been found in the roots of diseased cane and in the soil of infected fields, they can only be considered secondary symptoms consequent upon other primary causes. On the other hand it has been found in several experiments, especially in those carried out by Mr. Poel, manager of Kali Woengoe, near Kendal, that the disinfection of the soil of infected fields is followed by fair success. This may support the nematode theory. Mr. Kobus, whose name has already been mentioned, reports also to have seen experiments which point to an infection of the roots as being the cause of the sereh.

Mr. Van der Wiel, head chemist of a large sugar manufacturing firm of Eastern Java, believes that the disease is a consequence of the propagation of the cane by cuttings instead of seed (*Landbouwer*, June, 1890). This theory does not stand on the same lines with the two mentioned above, as it does not give an explanation of the character of the disease, but refers only to the way in which the disease may have been brought about. If the propagation by cuttings has really been the cause of the disease it may have favoured bacteria, or nematodes, or some other agent, which then became the immediate cause of the disease.—*The Queenslander*.

RUSSIA.

The Sugar Trade in 1890-91.

(From Consular Report, No. 877.)

The following tables, A and B, give particulars of the sugar industry. The average price for 1890 was about 4r. 30c. per poud (£31 8s. 6d. per ton), with delivery at the nearest station, while the average price on the London market for the same class of sugar was about £15 per ton. In my report for 1889 I gave a full explanation of the sugar ring, or "syndicate," as it is called here, the means adopted to secure a price on the home market of more than double what Russian sugar exported from here brings upon the London market.

In November, 1890, it was decided by the sugar refiners to form a "ring," similar in its action to that formed some years ago by the makers of sand sugar. Russia consumes about 18,000,000 pouds (290,323 tons) of refined sugar annually, while the refiners produce close upon 20,500,000 pouds (330,645 tons). This surplus quantity of 2,500,000 pouds (40,322 tons) plays an important part on the refined sugar market, and often causes an unlooked-for drop in price. The propositions laid before the meeting are interesting enough to give here:—

"1. That each refinery reduce its production by 10 per cent., thus bringing the production within the bounds of consumption."

This proposal was rejected, without discussion, as interfering with the "ring" of the makers of raw sugar.

"2. That the refineries export 10 per cent. of the refined sugar."

This proposal was also rejected, as by such a course the refineries would have all the expense of refining, while they would only receive upon the foreign market the price of raw sugar, there being little or no difference in price.

"3. That the refiners still receive from the makers of raw sugar the quantity the 'ring' of the latter society imposes upon them, but that they be allowed to export the surplus raw sugar on their own account.

"4. That during the next three years each refinery binds itself not to produce more than what will collectively produce the 18,000,000 pouds (290,323 tons) consumed in Russia, while the present surplus

be kept on hand until the state of the market allows the present existing raw sugar 'ring' to put it on the market."

Although the third proposal was most in favour, the fourth, proposed by Mr. Xaritonenks, the Kharkoff Sugar King, was adopted.

These "rings" are entirely against the interests of the sugar trade, and it seems strange that so little attention is taken of them in Russia, if an article in one of the local papers, and another in the *Financial News** are excepted. Such enforced limitation of production simply means increased cost of production. For example, factories in a position to produce 400,000 pouds are limited to 120,000 pouds (1,936 tons), therefore it costs such a factory as much to produce the latter quantity as it would almost do to produce the former, for we must consider that the cost of administration, interest on capital, depreciation of machinery, &c., are chargeable upon the year, while the campaign, or sugar-making season, lasts from three to four months. Again, the action of the "ring" is more detrimental to large factories than to small factories, most of the latter being allowed a limit of production which it is difficult for them to exceed, while large factories could produce from two to three times the quantity allotted by the "ring." Consequently, numbers of small factories have been, and are being started, and, protected as they are by the handicapping of the large factories, are, of course, able to show better results.

The action of the "ring" is now being felt by the planter of beetroot. The competition of America, India, and Australia upon the wheat markets of Europe is naturally felt by the Russian wheat grower, and he hailed with satisfaction the multiplication of sugar factories in his district, looking to the cultivation of beetroot to compensate him for the reduced returns upon wheat. Now he is informed that he must reduce his average of beetroot from 20% to 30%; not only so, but in one district not far from Kieff the factories have formed yet another "ring," viz., to reduce the price paid to planter as well as the acreage, and, unfortunately, the planters are unable to resist for the simple reason that the cost of delivery to another factory would be far more than the reduced price now offered him. Until these "rings" are abolished, there is little chance of sugar being sold in Russia at less than two or three times the price at which it is sold in Paris or London. Given the same price here, there can be little doubt but that

* Russian paper.

the consumption would rapidly increase, for among the peasantry sugar is an unknown quantity (*sic*); the present consumption is about 7¼lbs. per head of population, whereas in the United Kingdom it is given as 70lbs. per head. In other words Russia, with a population of something like 110,000,000, only consumes 350,000 tons of sugar, while the United Kingdom, with a population of about 39,000,000, manages to consume, in one way or another, 1,185,892 tons of raw and refined sugar per annum.

Table A.—*Showing the Quantity of Sugar Manufactured by 221 Factories having their Headquarters in Kieff or belonging to the Kieff Association of Sugar Manufacturers for the Seasons of 1889-90 and 1890-91.*

	1889-90.	1890-91.
	Tons.	Tons.
Home consumption	373,718	385,314
Exported	21,282	70,725
Total quantity manufactured	395,000	456,039
Quantity of beetroot used in manufacture.	4,315,358	4,867,434
	Acres.	Acres.
Acreage represented by above quantity of beetroot	650,823	741,384

Table B.—*Showing the Quantity of Sugar Exported by the 221 Factories having their Headquarters in Kieff or belonging to the Kieff Association of Sugar Manufacturers.*

Season.	Quantity Exported.	Value.	Price per Ton on Kieff Market.		
	Tons.	£	£	s.	d.
1884–85 / 1885–86	126,048	3,907,489	31	0	0
1886–87	60,168	1,293,612	21	10	0
1887–88	68,290	1,263,365	18	10	0
1888–89	88,044	1,804,902	20	10	0
1889–90	21,282	495,896	28	0	0
1890–91	70,725	2,222,534	31	8	6

THREE-ROLLER AND TWO-ROLLER MILLS—THEIR WORKING.

(Letter to the *Planters' Monthly.*)

To secure good grinding with a three-roller mill, quite a number of things must be considered, but that which is most important is the proper adjustment of the roller to suit the various kinds of cane.

The position of the return plate will also have considerable to do, both with the grinding and the safety of the mill.

The feed is also important, because if this is neglected, everything else that may be done is unavailing. The condition of the rollers is is also of considerable moment.

It is very difficult to give rules in regard to this matter, but most engineers have a number of things which guide them in the right direction.

In the first place, they like to hear their mills make that humming noise which indicates the friction and pressure on the return plate. This alone is a fair indication of good grinding, and the absence of it is the reverse. They also like the feed rollers to take in the cane regularly and smoothly, without slipping or jarring, and the delivery rollers to pass it on in the same manner. But this slipping of the cane does not depend so much on the setting of the mill as it does on the condition of the rollers. To get the highest extraction, as well as for the safety of the mill, the rollers should never be worked more than two seasons without being re-grooved. The importance of doing this is well appreciated when it is stated that a gain of two per cent. has often been made simply by putting the rollers in the best possible condition.

Setting of the Three-Roller Mill.

The difference in the distance of the opening of the feed and delivery rollers of a three-roller mill, I have reason to believe is very much less than is generally supposed; nor is the ratio fixed or arbitrary, but varies inversely to the hardness and quantity of fibre contained in the cane, this difference being greater as the cane increases in softness, and *vice versa.*

Years ago, when small mills were in use, it was customary to set the feed roller with one-half inch opening and the delivery roller one-

sixteenth of an inch opening, and some persons have thought that the conditions remain the same when under the pressure, but this is impossible.

When a machine is subjected to so great a strain or pressure, it will "give" in the bolts, timbers, and every possible direction, and in the case of a three-roller mill, we find it impossible to actually keep them just where they are supposed to be set; so that instead of this difference being four or five to one, it is more often three to one, and not unfrequently even less than this. Indeed, it would be almost impossible to find any two mills set exactly alike. The great thing is to set them so as to get the highest extraction and to avoid danger. But no amount of care in the setting or in the feeding of cane can at all compare with the hydraulic pressure regulator, particularly when attached to the delivery roller of the three-roller mill. This valuable device insures good grinding and comparative safety under all circumstances; but absolute safety can never be looked for while these mills are constructed as at present.

The Return Plate.

It is well-known that the great objection to the three-roller mill is the immense amount of waste in power resulting from the friction on the return. The power necessary to overcome this evil is variously estimated, but some persons believe it to be as much as is required to do the crushing of one pair of rollers. It is evidently very great, and although it remains an unknown quantity to most of us, we are well acquainted with one or two things in connection with it. In the first place, we find that it varies with the grinding being greater as the grinding is better, and *vice versa*. The position of the return plate seems also to effect it to some extent, and many consider that the lower it is set the greater the friction and also the danger. There can, I think, be no question as to the danger, because of the irregularity of the feed and consequently of the strain. It is found that when set too low this is the constant trouble, and there is no doubt that many an accident has been caused by this alone.

What the safest and best position really is must always be governed by the cane, or at least to some extent, but as I said before, the nearer they can be placed to the top roller the more regular is the feed and the less the danger of choking. Some of the largest mills here set them only 2½in. from the top roller.

It is a pleasure to turn from the three-roller to the two-roller or auxiliary mill, and I can say that after an experience of eight years with this type, I have never yet seen the least thing happen to them, notwithstanding that they worked up to their fullest capacity. These mills also run with very much less power and expense, less care and attendance.

To secure the best results from this mill, it is necessary to employ the hydraulic pressure regulator and a forced feed. Young's Patent Automatic Feeder is usually used for this purpose on these islands; and it invariably gives the best satisfaction; indeed it would be very difficult to invent a device that could so perfectly fulfil all the requirements necessary for a perfect feed, and the highest extraction of the juice.

MACERATION.

Maceration plays a very important part in connection with the two-roller mill, and it is by the use of this water that we are enabled to get the full benefit of this machine. This fact is most generally appreciated, and maceration is practised in all places where practicable, but unfortunately a great many mills have not boiler and steam capacity to carry this dilution down to what is required to secure the best result.

Hot water is most generally used here, but the objection to this is that while the trash will absorb it more quickly it causes it to swell very considerably, which necessitates a larger opening between the rollers. Cold water does not apparently have this effect, so consequently dryer grinding can be expected. But if dry grinding is not so much an object, hot water will give a higher extraction. We must not overlook another important point, and that is the diameter of the rollers.

Rollers of 36in. or 40in. diameter will, with equal pressure have an immense advantage over small rollers. They will take the trash much more easily, and keep it under pressure longer—two things of the greatest importance.

GRINDING CANE WITH THE THREE SET TWO-ROLLER MILL.

This system of grinding was at first thought to be a retrograde movement, going back, in fact, to our grandfathers' methods; but it has been both fully and forcibly demonstrated by careful experiments and real practice to be the safest and most economical method ever

practised in crushing cane. It is not only the safest, but the most thorough mode of extracting the juice from the cane, by any means short of diffusion;. and this is admitted by all persons who have had the pleasure of seeing them work.

With this new style there are three pairs of rollers set about 10 feet apart, the first set being grooved longitudinally, the grooves being cut both very wide and deep, so as to take a good hold of the cane.

The last two sets are connected with carriers, and also fitted with "Young's Automatic Feeders," and these mills do their work so thoroughly as to surpass any work ever done by grinding on these islands, and possibly anywhere else.

SUGAR BOUNTIES IN SWEDEN.

On the 2nd ult. there was a lively discussion in the First Chamber of the Legislature on the question of beet sugar taxation. The proposal of Mr. J. Andersson, to reduce the sugar duty and at the same time the tax on manufacture of beet sugar, was rejected without debate. The proposal of Mr. Albert Andersson, to raise the tax on beet sugar to half the customs duty at present levied on dark coloured foreign raw sugar, came under discussion. The proposer was of opinion that the beet sugar factories were improperly favoured to the disadvantage of the other sugar refineries. On the other hand, Mr. Cavalli thought the advantage given them was unimportant, and that the good results obtained from beet cultivation of late years were to be ascribed to circumstances of unusually favourable weather, and could not be expected to be a regular occurrence. Beet cultivation was also not merely an industrial question, but was closely connected with agricultural interests, and these must naturally be protected. Mr. Olsson called attention to the considerable expense attending the cultivation of the beet and the manufacture of beet sugar. This question was of the greatest importance to the southern provinces, and must, therefore, be treated with much caution. Messrs. Björnstjerna and Bennich (the latter formerly Director General of Customs) were of opinion that the premiums paid by the State to the beet sugar factories were much too high, and that the proposed slight increase would not do any harm to the agriculturists. The beet sugar industry ought not to be so favoured, at the expense of the other sugar industries,

that it might finally suppress them. Mr. Smith made the assertion that the experiments in sugar beet cultivation which he had conducted all over the country had led him to the conclusion that *no land in the world was so well adapted for the cultivation of the beet as Sweden.* The proposed advance in the sugar tax would not cause any injury worth mentioning to the already existing beet sugar factories, but would probably hinder the further development of this important industry. Sweden must so arrange matters as to be able to manufacture for herself all the sugar she required. It was a fact that those refineries which were working up foreign sugars had suffered losses, but the reason of this was to be looked for in their own obstinacy; if they would alter their refineries so as to be able to work up sugar beets, instead of trying to crush the beet sugar industry, they would in future have no cause of complaint.

The proposal of Mr. Albert Andersson was adopted by 68 against 60 votes. The Chamber decided further to address a letter to the Government requesting an alteration of the existing tax on beet sugar, both in regard to the amount of receipts and the system of taxation.

In explanation of the above communication we may remark that although the Swedish sugar duties are levied on the sugar itself, the tax is really on the beets, in the same way as that levied in France, inasmuch as the product obtained is only subject to taxation up to 6·25 per cent. raw sugar-yield. Up to now, the tax has amounted to two-fifths of the customs duty on sugar not lighter than No. 17 Dutch standard; such sugars being subject to a duty of 23½ öre;* as a result of the above-mentioned decision of the Chamber, the sugar tax is to be raised to half this customs duty. As the yield in raw sugar really amounts to more than 6·25 per cent., and the greater part of the sugar required in Sweden is obtained from abroad, and the customs duty on sugar is higher than the inland tax, the Swedish sugar manufacturers enjoy a twofold bounty.

The imports into Sweden in 1889 amounted to 39,543 tons (calculated in raw sugar); the production of the four factories existing in the 1888–89 campaign is given as about 6,000 tons. There are six raw sugar manufactories now in existence in Sweden—*Deutsche Zuckerindustrie.*

* Equal to about 3d. English.

NOTICES OF BOOKS.

The Engineering Review: A Monthly Journal for Civil, Mechanical, and Electrical Engineers. Edited by H. C. E. Andrée and Edward Walker.*

This new monthly publication, the first part of which appeared on the 9th ult., is designed to meet a want which has for some time become a pressing one. The increasing number of engineering journals, and the means adopted in every direction to bring new inventions, schemes, and processes before the public, causes the perusal and intelligent comprehension of these to be a sore tax on the time of men who can ill afford any addition to their numerous engagements. The new review seems to us to supply the want here indicated, in furnishing a succinct, abridged, and clearly written resumé of the most noteworthy novelties in the engineering world as fast as they make their appearance. We understand it is intended for practical readers, and not as a means of puffing goods or inventions; and if the editors reach their aim, they will supply, monthly, the whole gist of what is contained in the other papers. There will also be a lot of original matter, and we think this journal will be as welcome to some professional and commercial men, as has been that boon to overworked literary men, the *Review of Reviews*. The objects sought are conciseness, clearness, logical order, and comprehensiveness, and we heartily wish the new venture success.

Pantobiblion: An International Bibliographical Review of the World's Scientific Literature. Edited by A. Kersha, C.E., St. Petersburg, Fontanka, 64.

We confess to feeling quite unable to assess the merits of this new publication. The scope is so ambitious, and the ground covered so extensive, that specialists like ourselves are really not competent to decide how far the review can be considered a success. This first number consists of 287 pages of notices, short and long, of new literature on the most diverse scientific subjects, in some (as the preface tells us) fifteen languages. Although we have a vague feeling that the arrangement of the matter renders rapid consultation difficult, we prefer to abstain from expressing an opinion of the practical value. If typographical accuracy can be considered a criterion, it appears to be present in a remarkable degree, as we have not, although fairly conversant with the greater part of the various tongues, been able to distinguish a single error, though the English bears a strong American impress. Time alone can show how far the journal will justify the great labour that has evidently been spent on it. Even as a mere curiosity it is really worth perusal.

* Published at St. Paul's Chambers, 19, Ludgate Hill, London, E.C.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. THOMPSON, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; 63, Long Row, Nottingham; and 323, High Holborn, London.

ENGLISH.

APPLICATIONS.

6587. H. HENCKE, London. *Improvements in the method of and in apparatus for drying and evaporating.* 16th April, 1891.

6795. W. H. COWARD, London. *An improved grinding or pulverising mill.* 20th April, 1891.

6998. W. EDGELL, Bristol. *Improvements in or connected with machines for weighing parcels of crushed sugar, tea, and other substances.* 23rd April, 1891.

7187. S. M. LILLIE, London. *Improvements in evaporating apparatus.* Date applied for under Patents Act, 1883, sec. 103, 26th September, 1890, being date of application in United States. (Complete specification.)

7704. H. BURGESS and C. D. DAVIS, London. *Vacuum evaporating apparatus.* (Complete specification.) 4th May, 1891.

7867. W. P. THOMPSON, Liverpool. (Communicated by Wirth & Co., Germany.) *Improvements in evaporating apparatus for concentrating liquids.* 7th May, 1891.

7869. W. P. THOMPSON, Liverpool. *Improvements in evaporating apparatus for concentrating liquids of a pulpy nature.* 7th May, 1891.

8026. E. SEITZ, London. *An improved centrifugal pump.* 9th May, 1891. (Complete specification.)

ABRIDGMENTS.

4309. JAMES FOSTER, of Baltic Chambers, Sunderland, engineer. *Improvements in and relating to evaporating and distilling apparatus.* March 19th, 1890. These improvements are especially applicable to double or multiple effect apparatus of the vertical type. According to one plan, each vessel is divided into two or more separate compartments by vertical or other division plates or diaphragms, so that two or more distinct evaporating chambers are formed in each. Two sheets of drawings show the details of construction.

6484. GEORGE FLETCHER, of Masson Works, Litchurch, Derby, engineer. *Improvements in evaporating pans.* April 28th, 1890. The

inventor describes open pans working under atmospheric pressure (or closed vacuum pans), the heating surface of which is formed by tubes fixed in tube plates, secured to the sides of the pans, and fitted with one or more large circulating tubes, the combined areas of which equal the total area of the heating tubes.

5209. GEORGE F. REDFERN, of Messrs. G. F. Redfern & Co., 4, South Street, Finsbury, London, patent agents. (A communication from abroad, by Moriz Weinrich, of St. Louis, Missouri, U.S.A.) *Improvements in washing and cleaning raw sugar.* April 5th, 1890. The raw sugar is intimately mixed with a certain amount of cold or hot concentrated syrup, and 8% to 30% by weight of some indifferent light and porous material such as cork, corn cobs, wood, &c., reduced to pieces about ⅛in. diameter is then added. The mixture is placed in cells similar to a diffusion battery and treated with "white liquor or clairce." The invert substance may be afterwards removed by sifting, &c.

13163. MARIE J. L. MARIE, of La Martinique, West Indies, manufacturer. *Improvements in centrifugal machines.* August 21st, 1890. This is a continuously acting machine. A vertical basket is provided, the central portion of which is filled from top to base with a cylindrical core or drum, whose outer surface carries a continuous helical blade. The core and the basket are revolved in the same direction, but at slightly different speeds, so that the material (which is fed into the space between them) is subjected to the centrifugal action, and receives a travelling movement at the same time. A belt conveyor is used to take away the finished product. Steam may be injected.

AMERICAN.

ABRIDGMENTS.

441318. JAMES A. MORRELL, of Lansdale, assignor of one-half to Gideon W. Marsh, of Philadelphia, Penn., U.S.A. *Apparatus for evaporating liquids.* November 25th, 1890. The liquid under treatment is heated above its usual boiling point and passed up a pipe into a highly heated chamber, being there suddenly released in the form of a very fine horizontal spray which dashes against an enclosing screen or jacket. Thence the liquor falls down a vertical outer casing. During its descent it parts with the moisture very rapidly, and when sufficient is collected at the base of the chamber, it is withdrawn through a trapped pipe.

441319. James A. Morrell, of Lansdale. *Process of evaporating liquids.* November 25th, 1890. This is a patent for a process intended to be carried out by means of the apparatus described above (*vide* 441318). The process consists in heating a liquid in a vessel or tube above its normal boiling point, and in charging it with compressed air or gas, and then liberating the solution thus superheated in the form of minute jets or spray in a heated chamber. The inventor states that the process is especially applicable to saccharine solutions used in refining.

441320. James A. Morrell, of Lansdale. *Apparatus for evaporating liquids.* November 25th, 1890. This apparatus is similar to that described under No. 441318 (*q.v.*), with the addition of means for injecting gas or air into the solution before liberating it in the vertical chamber, thus assisting the evaporating operation.

441321. James A. Morrell, of Lansdale. *Apparatus for evaporating liquids.* November 25th, 1890. This invention is somewhat similar to the above-mentioned. A vertical steam jacketted tower is used, in the top end of which the liquid is sprayed. Mechanically actuated scrapers are employed to clear away the concentrated solution or crystals from the sides of the tower.

441371. James A. Morrell, of Lansdale. *Concentrating and evaporating solutions.* November 25th, 1890. Apparently a development of the preceding ones. The liquid charged with gas passes in a spiral direction up an annular space formed between an outer steam jacket and a steam-heated central core, its temperature being thus raised to a high degree. It then passes by a branch pipe to a second heated chamber, into whose top it is sprayed, and, a certain degree of vacuum being maintained, the larger portion of the vapour is extracted and removed. The partially concentrated liquid flows away down a gradually decreasing steam-heated worm pipe, which retards its escape, and thus gives time for a further concentration.

441621. James A. Morrell, of Lansdale. *Apparatus for concentrating solutions and extracting solids therefrom.* November 25th, 1890. This is a patent for a rather more complicated form of apparatus acting on much the same principle as the above described ones. As shown and described in the specification, non-conducting material surrounds all the chief points where detrimental radiation would otherwise occur. Details of construction are shown. The inventor states that the process of evaporation is so rapid that there is no time

for oxidation (inversion ?) to occur, although the solution is sprayed in presence of air.

442313. J. H. B. Butts, of Thomaston, Georgia, U.S.A. *Evaporator and skimmer.* December 2nd, 1890. The object of the invention is to automatically remove the scum from boiling syrup by means of simple devices. The invention consists in placing a grate-like skimmer at an incline over the open pan, so that the said skimmer will incline upwardly from the juice entrance end of the evaporator. During the boiling and bubbling of the juice the scum will collect on the bars of the skimmer and gravitate to the entrance end. For the purpose of properly supporting the skimmer at an inclination, the circulating or deflecting plates of the pan are made of different heights, gradually increasing from the entrance end.

442122. William O. Johnson, of Peedes, Texas, U.S.A. *Evaporator.* December 9th, 1890. This is an improvement on that kind of evaporator which consists of an open pan provided with deflecting plates, and which is supported on rockers, so that it may be adjusted to regulate the level of the liquor. The rockers are in this case mounted in convenient bearings to facilitate adjustment. The furnace is slightly longer than the pan, the latter being thereby properly heated from end to end. A cylindrical vessel, adapted to contain the juice to be treated, may be inserted in a recess in the furnace flue for the purpose of giving a preliminary heating to the said juice.

442478. George H. Brower, of Roann, Ind., U.S.A. *Evaporator.* December 9th, 1890. The novelty in this pan appears to be the provision of supplementary side troughs round the pan proper for the purpose of retaining the scum.

443549. Carl Steffen, of Vienna, Austria-Hungary. *Apparatus for refining loaf sugar in moulds.* December 30th, 1890. The conical moulds, each having a perforated apex, are filled with raw sugar and placed vertically one above the other, being supported by a suitable frame in such manner that there is a through passage from end to end of the series. The lixiviating fluid ("cleare") is now passed through them from top to bottom, becoming more and more impure as it descends. When the first or topmost mould-full is properly refined, it is removed and another placed underneath the series, the second taking the place of the first, and so on. The moulds are raised and maintained in position by hydraulic pressure and catches. The

operation is now continued till a second mould-full is clarified, when the substitution and raising are again repeated.

440107. GUSTAVE ADANT, of Brussels, Belgium. *Manufacture of sugar.* January 6th, 1891. This invention relates to the manufacture of sugar, with special reference to the making of tablets or slabs, from which cubes are afterwards obtained. The invention comprises improvements in the centrifugal, whereby the basket is detachable and may be readily dismantled for the purpose of removing the purified slabs of sugar for drying. The purification of the sugar by means of refining liquor is effected in the centrifugal itself. The basket of the machine is composed of a top and a bottom ring, having a number of radial wedge-shaped partitions, which divide the space between them into rectangles. The alternate partitions are attached to the top and bottom rings respectively, and the two sets may be coupled, or dismounted, for removing the slabs formed between them. The inventor's objects are stated to be simplicity and saving in material and labour.

444345. E. R. GABBETT, of Old Charlton, assignor of one-half to S. B. Boulton, T. B. Haywood, and H. E. Boulton, all of London, England. *Apparatus for mixing liquids.* January 6th, 1891. A tank or other vessel of suitable shape is used to hold the liquid, and a vertical hollow truncated cone open at each end is immersed therein and revolved, thus causing the liquor within said cone to rise (or fall) by centrifugal force. The cone is preferably provided internally with ribs.

444470. WILLIAM NELSON VILLAVASO, of New Orleans, Louisiana, U.S.A. *Molasses mixer.* January 13th, 1891. Two or more propellor blades revolve in the casing of the machine, generally in opposite directions. The density of the material may be reduced by passing in water through a perforated pipe. The use of warm water has a less detrimental effect than steam, as less inversion or colouring results.

IMPORTS AND EXPORTS (UNITED KINGDOM) OF RAW AND REFINED SUGARS.

JANUARY 1ST TO APRIL 30TH.

Board of Trade Returns.

IMPORTS.

RAW SUGARS.	QUANTITIES.		VALUE.	
	1890.	1891.	1890.	1891.
	Cwts.	Cwts.	£	£
Germany	2,343,645	2,353,721	1,377,780	1,483,378
Holland	133,023	171,580	72,700	103,152
Belgium	376,900	474,944	190,297	280,424
France	719,655	709,741	441,465	473,862
British West Indies & Guiana	475,278	383,307	368,757	305,029
British East Indies	58,770	110,832	26,161	60,874
China and Hong Kong	....	....	....	....
Mauritius	6,571	59,526	4,925	38,501
Spanish West India Islands	....	18,000	....	14,175
Brazil	121,496	275,577	72,791	164,344
Java	262,460	564,808	201,130	414,601
Philippine Islands	42,100	297,145	20,810	163,917
Peru	265,352	184,186	178,922	128,967
Other Countries	113,787	184,930	80,497	126,508
Total of Raw Sugars	4,913,037	5,788,297	3,036,235	3,757,732
Molasses	97,799	151,996	35,501	50,755
Total Sugar and Molasses	....	....	5,610,505	6,839,230
REFINED SUGARS.				
Germany	1,584,059	2,034,326	1,282,340	1,656,057
Holland	557,320	512,453	465,702	434,527
Belgium	54,951	76,387	49,281	65,959
France	911,230	605,646	737,616	507,124
United States	3,854	421,467	3,757	375,744
Other Countries	98	11,416	73	9,332
Total of Refined	3,111,512	3,661,695	2,538,769	3,030,743

EXPORTS.—REFINED SUGARS.

	Cwts.	Cwts.	£	£
Sweden and Norway	23,651	30,434	16,935	23,447
Denmark	34,751	48,641	21,035	30,548
Holland	28,992	31,766	20,530	22,837
Belgium	9,311	8,033	6,382	5,494
France	4,083	54	2,636	40
Portugal, Azores, & Madeira	32,516	29,847	21,302	20,600
Italy	32,223	13,705	21,468	9,613
Other Countries	72,772	81,883	54,514	63,814
Total of Exports	238,299	244,363	164,811	176,393

IMPORTS OF FOREIGN REFINED SUGAR.

The British Sugar Refiners' Committee furnish us with the following figures, giving the imports of foreign refined sugar for the month of April, 1891, compared with the corresponding month of the two preceding years, and the average monthly imports for the year compared with those of 1888, 1889, and 1890, distinguishing the quantities of "Lumps and Loaves" from "other sorts," and giving the separate imports from each country:—

Countries from which Sugar has been imported.	"Lumps and Loaves."							"Other Sorts." Including Crushed Loaf, Granulated. Crystallized, &c.							Total.						
	Monthly Average.				Apl.	Apl.	Apl.	Monthly Average.				Apl.	Apl.	Apl.	Monthly Average.				Apl.	Apl.	Apl.
	1888	1889	1890	1891	1889	1890	1891	1888	1889	1890	1891	1889	1890	1891	1888	1889	1890	1891	1889	1890	1891
	Tons.	Tons.	Tons.	Tons.	Tons	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France.............	1686	2373	2707	1741	1897	3182	1432	4855	8596	8547	5829	2265	3849	2485	6541	10969	11254	7570	4162	7031	3917
Holland	3267	2294	2858	3019	2435	3134	3099	2675	3354	4580	3386	3149	4061	3934	5942	5648	7438	6405	5584	7195	7033
Germany & Austria ..	1510	2573	2512	2539	3403	3177	3936	11729	13844	18333	22890	22938	20774	36377	13239	16417	20845	25429	26341	23951	40313
Belgium	622	827	390	613	1074	436	379	227	225	344	342	309	149	270	849	1052	734	955	1383	585	649
United States	8	..	96	214	..	89	662	157	42	1123	5054	14	85	13842	165	42	1219	5268	14	174	14504
Russia.............	..	23	25	..	..	..	..	1959	2015	29	140	953	..	201	1959	2038	54	140	953	..	201
Other Countries	1	239	..	..	58	..	..	2	355	..	2	7	..	10	3	594	..	2	65	..	10
Total	7094	8329	8588	8126	8867	10018	9508	21604	28431	32956	37643	29635	28918	57119	28698	36760	41544	45769	38502	38936	66627

SUGAR STATISTICS—GREAT BRITAIN.

FOR THE FOUR PRINCIPAL PORTS.

TO MAY 16TH, 1890 AND 1891.

IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

	STOCKS.		DELIVERIES.		IMPORTS.	
	1891.	1890.	1891.	1890.	1891.	1890.
London	34	.. 31	114½	.. 107	123½	.. 89
Liverpool ..	37	.. 62	113	.. 109½	97½	.. 85
Clyde	47	.. 47½	77	.. 85½	88	.. 93
Bristol	2	.. 2	27	.. 25½	25½	.. 25
Total ..	120½	142½	331½	327½	334½	292

The above figures do not represent accurately, or to the full extent, the position and movements of sugar in the United Kingdom, as Hull, Leith, &c., are not included, there being no published returns for these ports.

SUGAR STATISTICS—UNITED STATES.

(From Willett & Gray's Report.)

FOR THE FOUR PRINCIPAL PORTS. IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND. FOR APRIL, 1891 AND 1890.

	STOCKS. May 1st.		DELIVERIES. In April.		IMPORTS. In April.	
	1891.	1890.	1891.	1890.	1891.	1890.
New York	27	.. 12½	95	.. 97	102	.. 100
Boston	3½	.. 1	25	.. 14½	24	.. 15½
Philadelphia....	3	.. 1	42	.. 31	42	.. 31½
Baltimore	...	..	2½	.. ..	2½	.. ..
Total	33½	14½	164½	142½	170½	147
Total for the year			513½	435	518	438

NEW YORK PRICES FOR SUGAR.

From Willett & Gray's Report, May 14th, 1891.

FAIR REFINING.	96o/o CENTFS.	GRANULATED.	STAND. A.	STOCK IN FOUR PORTS.
May 14, 1891.—2 15-16c.*	3¼c.*	4⅛c.	4c.	Jan. 1, 1891— 27,756 tons.
May 15, 1890.—4¾c.	5⅝c.	6-6 1-16c.	5⅝-11-16c.	Jan. 1, 1890— 11,169 tons.
May 16, 1889.—6 5-16c.	7¼c.	8⅛c.	8¼c.	Jan. 1, 1889— 32,254 tons.
May 17, 1888.—4¾c.	5½c.	6¾c.	6 3-16-¼c.	Jan. 1, 1888— 47,798 tons.
May 10, 1887.—4 7-16c.	5⅛c.	5 11-16-¾c	5 5-16c.	Jan. 1, 1887—102,279 tons.
May 21, 1886.—4⅞c.	5⅝c.	6¼-5-16c.	5⅞c.	Jan. 1, 1886— 57,328 tons.
May 15, 1885.—5⅛c.	5 15-16c.	6¾c.	6¼c.	Jan. 1, 1885— 89,186 tons.
May 15, 1884.—5 5-16c.	6⅛c.	7 1-16c.	6⅜c.	Jan. 1, 1884— 60,900 tons.
May 17, 1883.—7¾c.	7¾c.	8 13-16c.	8⅝c.	Jan. 1, 1883— 50,297 tons.
May 18, 1882.—7⅝c.	8 3-16c.	9¾-⅞c.	9 5-16-⅜c.	Jan. 1, 1882— 43,927 tons.

* Net Cash.

STOCKS OF SUGAR IN THE CHIEF MARKETS OF EUROPE ON THE 30TH APRIL, 1891, FOR THREE YEARS, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal entrepôts	TOTAL 1891.	TOTAL 1890.	TOTAL 1889.
117	300	255	220	35	23	950	906	616

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING 30TH APRIL, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal entrepôts	TOTAL 1891.	TOTAL 1890.	TOTAL 1889.
1385	525	481	316	61	387	3155	2905	2815

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE PRESENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1890-91. Tons.	1889-90. Tons.	1888-89. Tons.	1887-88. Tons.
German Empire..	1,335,000 ..	1,264,607 ..	990,604 ..	959,166
France	700,000 ..	753,078 ..	466,767 ..	392,824
Austria-Hungary.	760,000 ..	787,989 ..	523,242 ..	428,616
Russia	530,000 ..	456,711 ..	526,387 ..	441,342
Belgium........	200,000 ..	221,480 ..	145,804 ..	140,742
Holland........	65,000 ..	55,813 ..	46,040 ..	39,280
Other Countries..	80,000 ..	80,000 ..	87,000 ..	79,980
	3,670,000	3,619,678	2,785,844	2,481,950

Mr. Licht still leaves his estimates unchanged, probably considering that the effect of the various factors which go to alter these estimates is as yet somewhat of a balancing nature.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

We have again another disappointing month to report; sales of cane sugar have been slow, and a slight decline had to be submitted to for most sorts, though considering the extremely sluggish market, it is a matter of wonder that prices have been so well maintained. Refined sorts have suffered a slight decline, which may be put at about 6d. all round.

The following is from the *Produce Markets' Review*:—

"The state of things in Refiners' Yellow Crystals is at present a singular one. Attracted by the relatively high prices of Demeraras, our manufacturers commenced to turn out Crystals in increasing quantities, instead of making Centrifugals. The refiners had originally so large a margin for profit that they were induced to turn out more than the demand could absorb. Hence a rapid and remarkable fall in prices, till a point has been reached at which refiners' crystals are being sold much below the actual cost of production, on the basis of the existing quotations for beet. A heavy diminution in the out-turn must inevitably follow."

Beet has also been remarkably quiet, and prices close decidedly below those of last month. As far as can be judged from the most reliable statistics, and making full allowance for the disturbing elements introduced by the notorious McKinley Bill, and now by the somewhat unexpected German Sugar Duties Bill,—the tendency of prices may be expected to be towards an advance, and it is possible we have seen the lowest point for some months to come. The money market, and the holidays, and again the very late season, are all in succession being blamed for the present state of things; our own opinion is that it is mainly owing to uncertainty and hesitation in almost every quarter.

Present quotations for the standard qualities, as under, are:—

Floating.			Last Month.
Porto Rico, fair to good Refining	13/3 to 14/3	against	13/3 to 14/3
Cuba Centrifugals, 97°/₀ polarization	14/9	,,	15/-
Cuba, fair to good Refining	13/6 to 13/9	,,	13/6 to 13/9
Java, No. 14 to 15 D.S.	15/- to 15/1½	,,	15/3 to 15/6
British West India, fair brown	12/9	,,	12/9
Bahia, low to middling brown	11/- to 11/6	,,	11/- to 11/6
,, Nos. 8 to 9	12/6 to 13/-	,,	12/6 to 13/-
Pernams, regular to superior Americanos	11/9 to 13/6	,,	11/9 to 13/6

Landed.			Last Month.
Madras Cane Jaggery	10/3	against	10/6
Manila Cebu and Ilo Ilo	10/-	,,	10/3

Paris Loaves, f.o.b.	17/-	against	17/9
Russian Crystals, No. 3, c.i.f.	15/1½	,,	15/7½ to 15/9
Titlers	18/3	,,	18/9
Tate's Cubes	20/-	,,	20/6
Beet, German and Austrian, 88%, f.o.b.	13/-	,,	13/6

THE SUGAR CANE.

No. 264. JULY 1, 1891. VOL. XXIII.

All communications to be addressed and all cheques, &c., made payable to "EDWARD SUTTON, EDITOR OF THE SUGAR CANE, MANCHESTER," which address is sufficient.

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☞ The Editor is not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

We have pleasure,—in view of the fact that Messrs. Manlove, Alliott & Co., of Nottingham, are our oldest subscribers,—in noting that a portrait and biographical sketch of their very able and experienced manager, Mr. John M. C. Paton, appeared in the *Machinery Market and Exporter* of last month.

Apropos of the departure of Sir Henry Blake on leave of absence, the Jamaica *Colonial Standard* has the following remarks:—

As we have often remarked, the holding of the Exhibition of 1891 will always be regarded as one of the most remarkable events in the recent history of Jamaica. Sir Henry Blake's reputation will derive additional lustre from a success to which he, by his unflagging zeal and untiring efforts, has so largely contributed. The indirect benefit, and the full fruitage of advantage attendant on the holding of the Exhibition lie in the future, but the people of Jamaica are already reaping a portion of the fruit of the seed sown by the promoters of the Exhibition. For the past eighteen months Sir Henry has laboured with indefatigable energy to make the first Exhibition in the British West Indies a signal success; and, though it has been well said that the labour we delight in physics pain, His Excellency's efforts must have been attended at times with harassing care, worry, and anxiety.

In Jamaica the prospectus of a proposed central sugar factory has been issued. We have long thought that if in any of the English West India Islands central factories could be a success, they would be so in Jamaica.

Mr. Morris, of the Royal Botanic Gardens at Kew, who has been reading a paper on the West Indies, in Barbados, seems to have hit the right nail on the head in pointing out that sugar alone could not profitably occupy all the available lands suitable for cultivation in the West Indies—that what was wanted was a diversified system of cultural industries, so that there may be no collapse of prosperity on account of fluctuation in the price of any single article.

The fact that the West India Islands have suffered severely from having to depend mainly on one staple article of production,—the position of which has undergone so remarkable alteration,—must, we think, have forced itself on the minds of many. During the discussion that ensued, Mr. Webster, M.P., pointed out that the West Indies formed a perfect Riviera, to which invalids and well-to-do people in England might resort as an escape from her detestable winter climate and horrible fogs. The projected alterations in the sailings of the R. M. Steam Packet Company's steamers will bring us within less than a fortnight of the sunny skies and magnificent scenery of the Antilles. Mr. Webster augurs well for the future of these islands, and recommended the Barbados system, where labour is employed by capital, and where the farms are well cultivated. What is wanted is capital and enterprise, and sooner or later the United Kingdom and also the American continent will, he thought, aid our West Indian friends in developing their great natural resources.

A very interesting paper has been read before the Mauritius Chamber of Agriculture by Mr. Bernard, advocating and adducing cogent reasons for the establishment of an Agronomic Station, similar to those existing in many other cane-producing countries, and this important subject is receiving full attention. It seems scarcely possible that two opinions can exist as to the need and value of such an establishment.

The Hawaii *Planters' Monthly* refers to the operation of the McKinley Tariff Bill in the following terms:—

"The very high retail prices of sugar and rice now prevailing on these islands are creating much complaint and irritation. The people of a country that produces 260,000,000 pounds of raw sugar should not be long left to pay 7½ cents per pound for granulated sugar, nor 8½ cents for rice, when the product amounts to about 30,000,000 pounds. It is bad enough to hear of labourers and mechanics compelled (by

the McKinley Bill of course) to submit to a reduction of wages, but for them to be compelled to pay such extravagant prices for the necessaries of life is too much. If there be no other remedy, better to abolish the duty on rice and sugar and let us obtain our supplies from Japan and China, if necessary, to secure these staples at reasonable prices."

The same journal publishes an account of extraordinary extraction by a new six-roller mill, made by the Honolulu Iron Works Co., and remarks:—

"If we rightly understand Mr. Walbridge, the whole crop averaged 93·38 per cent., as stated. It is to be regretted that more data were not obtained showing entire weight of cane ground and juice boiled, as well as the acreage of cane grown for the crop of 1891."

Consular reports from the Philippine Islands show that from Manila, 71,318 tons less were exported in 1890 than in 1889. Of the total quantity, 68,500 tons went to the United States and Canada (less than half the quantity of shipments in 1889), and 40,000 tons to Great Britain; to other countries, about 39,000 tons. From Iloilo, about 14,000 tons less were shipped than in 1889, the total quantity in 1890 being 96,000 tons. From Cebu, only 3,455 tons were exported in 1890, against 11,862 tons in 1889. This is owing to the low prices, and cane tracts are now being planted with tobacco and maize.

The total production of sugar in Java in 1890 was 400,000 tons, the largest previous crop having been 390,000.

From the letter addressed by Mr. N. Lubbock, the Chairman of the West India Committee, which will be found on page 342, it will be seen that the question of the London Convention is, very properly, not going to be allowed to sleep. Germany has fulfilled her pledge, and the question is entering on a more hopeful stage. A translation (on page 344), of a so-called fairy tale, which has appeared in the Berlin *Ulk*, will serve to show the opinions held in some quarters in Germany.

The Strawsoniser machine (to which we referred in August, 1889), invented by Mr. G. F. Strawson, and manufactured by Messrs. Hornsby and Sons, Limited, of Grantham, has been doing good work

in experiments made this year, and proved a most efficient appliance for spreading nitrates and other fertilisers and scattering sulphur, petroleum, &c., for the destruction of insect pests.

The present number contains several papers of more or less value, and certainly great interest on what may be described as the burning question of Diffusion as compared with Mill work. Whatever may be the merits of diffusion, and unquestionably they are many and great, it is quite certain that many of our planters and sugar manufacturers are intending, for the present at any rate, to adhere to the improved crushing system. We commend the papers in question to the perusal of our readers; in the interchange of opinions and facts lies the safest means of arriving at the truth on this important point.

In our editorial remarks last month we referred to the purchase and probable re-opening of the Lavenham sugar factory. We now learn that the intention of the purchasers is to endeavour to rent the plant, &c., to a syndicate. The matter is of no small importance from a national point of view, and it is to be hoped that the enterprise may succeed, for there appears, as yet, no reason whatever why we should not grow our own sugar beets to a profit, and to the great advantage of all concerned. Dr. Schack-Sommer, who has been so actively engaged in promoting the effort to establish a new national industry, informs us that he has just visited the Lavenham factory, accompanied by an Austrian expert, and finds the machinery of the newest and most approved type, requiring only some few additions to make it everything that it ought to be. The purchasers wish to take a pecuniary interest in the enterprise. Dr. Schack-Sommer has wisely stipulated, as a condition of his endeavouring to form a company, that the farmers of the district shall sign undertakings to grow a certain quantity of beets of the proper kind and for a certain number of years at a fixed contract price. Such co-operation is nothing but reasonable.

The following information as to the results of working of German factories and refineries, new factories in process of erection, &c., is obtained mainly from the *Deutsche Zuckerindustrie*:—

DIVIDENDS DECLARED.

Pommersche Provinzial Zuckersiederei, Stettin, 25%; *Norddeutsche Zuckerraffinerie*, Frellstedt, 10% for the second half-year; *Körbisdorf*, 8%; *Vienenburg*, 6½%; *Rositzer Zuckerraffinerie*, 4%.

NET PROFITS SHOWN.

Rostocker Actienzuckerfabrik (capital, M. 600,000), M. 163,210; *Northeim* (M. 1,050,000), M. 130,778; *Nakel* (M. 699,600), M. 59,676; *Aderstedt*, M. 27,451; *Wegeleben* (M. 1,248,000), M. 324,116; *Klützow* (capital, M. 855,000), M. 167,403; *Weissenfels a. S.* (M. 225,000), M. 74,495; apparently nothing is here written off for amortisation, &c.

New factories are being erected at Kulm (Saxony) and Bartsch (Pomerania). Three large refineries are to be erected at Danzig, Oschersleben, and Hamburg respectively.

Referring to our previous notice of payment of 35% dividend by the *Hallesche Maschinenfabrik und Eisengiesserei*, it appears that the turn-over of this establishment for 1890 was M. 3,608,030 = over £180,000. Nearly the same amount was reached in 1889, when a dividend of 32% was paid; but for the uncertainty respecting the sugar legislation in Germany, the business done in 1890 would have been much greater.

RUSSIA.—Trials made in Siberia show that beets containing from 11 to over 16% of sugar can be grown there.

JAPAN.—The new beet sugar factory at Sapporo, under the supervision of Mr. Hori, is now in full operation, and can work up 200 tons daily. The whole of the machinery was supplied by the Sangerhäuser Maschinenfabrik.

We have been compelled to omit the review of quite a number of most interesting publications relating to the sugar industry in Louisiana, Nebraska, &c., which we hope to deal with next month.

☞ We would call the attention of our readers to the advertisement, on the first page, of the sale, on the 27th inst., of Messrs. Schwartz's refinery plant.

THE SUGAR BOUNTIES CONVENTION.

The following letter has been addressed to the Secretary Stateof for Foreign Affairs, by the Chairman of the West India Committee :—

West India Committee,
Billiter House, E.C.,
5th June, 1891.

To the Most Hon. the Marquis of Salisbury, K.G.,
Foreign Office.

My Lord Marquis,

I have the honour to recall to your Lordship's attention the many representations which have been made to you in support of the Bill, introduced into the House of Commons in the Session of 1889, to comply with the provisions, so far as they relate to the engagements of Her Majesty's Government in respect of the Convention entered into with Foreign Sugar-producing countries in the year 1888. Article 1 of the Convention provided that the high contracting parties engaged to take such measures as shall constitute an absolute guarantee that no open or disguised bounty shall be granted on the manufacture or exportation of sugar Various details as to proposed legislation to carry out this engagement were further contained in the Convention, which also provided for the establishment of a permanent International Commission, charged with the duty of watching the execution of the provisions of the Convention. Since the date of the Convention, which was signed by your Lordship and Baron Henry de Worms, as the British Plenipotentiaries, on the 30th of August, 1888, changes have been made in the Sugar Laws of the contracting countries, but nevertheless maintaining the bounty system. It will be within your Lordship's recollection that one of the principal objections to the Convention put forward in this country was that if France did not finally agree to it, that country would, in connection with general commercial treaty negotiations with this country, seek means to retaliate by hostile provisions in her tariff against British manufacturers. Irrespective, however, of the Sugar Convention, France has apparently determined upon the most hostile treatment of British manufacturers. This is clearly shown by the third report of the Trade and Treaties Committee, in the first paragraph of which it is stated—" From the representations already made to us we were

convinced that the proposed minimum tariff presented important increases of duty on most of the chief articles of British manufacture exported to France, and must therefore be injurious to British trade with that country." The second paragraph is as follows :—"During the passage of the Tariff Bill through the Committee of the Chamber of Deputies the rates of duty, which were provided for by the Government measure, have been materially increased in many instances, and the classifications of articles in the tariff have been made still more complicated, with the view of protecting every interest in France except the consumer." And it is further stated in paragraph three—"Whatever may be the expressed intention or pretexts for these arrangements, they will constitute, if carried out, an act of commercial hostility to neighbouring countries." It is evident, therefore, that the non-ratification of the Sugar Convention in the supposed interest of France, has had no effect in preventing that country from adopting a hostile policy in regard to British manufacturers, but on the contrary has been followed by an attitude of increased hostility towards all the great manufacturing industries of the United Kingdom. The effect of the continuance of the bounty system is not advantageous to the English consumer, who is becoming more and more exclusively dependent on one, and that an inferior source of supply. Bounty-fed beet sugar has almost entirely dislodged cane sugar in the United Kingdom, as the following figures will show:—

IMPORTS INTO UNITED KINGDOM.

	1886.	1887.	1888.	1889.	1890.
	Tons.	Tons.	Tons.	Tons.	Tons.
Beet sugar..	584,980 ..	767,356 ..	659,177 ..	855,769 ..	984,904

	1886.	1887.	1888.	1889.	1890.
	Tons.	Tons.	Tons.	Tons.	Tons.
Cane sugar (British and Foreign)....	540,422	480,943	577,833	472,605	299,848

The Convention aimed at removing all artificial advantages enjoyed by one country over another in sending its sugar into the United Kingdom, and thus restoring free trade upon the British market. Its ratification has been delayed out of regard to the susceptibilities of France. That country responds by at once beginning a commercial war against all the principal English industries, and any reason for further delay in carrying out the Convention has entirely disappeared.

I have now to ask whether your Lordship would be pleased to re-open negotiations with Germany, Austria-Hungary, and the other powers who agreed to the Convention, so that its ratification may now be proceeded with in due course.

(Signed), N. Lubbock, Chairman.

(*Reply.*)

Foreign Office, June 11th, 1891.

To the Secretary, West India Committee.

Sir,

I am directed by the Marquis of Salisbury to acknowledge the receipt of your letter of the 5th instant, in which you suggest that having regard to the action of France in imposing hostile tariffs against British goods, negotiations should be re-opened with the countries who agreed to the Sugar Convention of 1888, with a view to its ratification. In reply, I am to inform you that your letter shall receive attention.

I am, &c.,

(Signed), James Fergusson.

IT BROUGHT ITS OWN RETRIBUTION.

A Commercial and Political Fairy Tale in the latest style.

There was once a man, named Baron Gierschlung, who had a huge sugar manufactory which brought him in so much money that he was able to afford to bathe every day in chocolate, and grease his carriage wheels with caviar. And with all this he had no need to do a hand's turn, for gold flowed in upon him of itself in bushelsful. However, he had never been used to anything else, and so, one day, when by some chance the twenty-mark pieces came tumbling into his cash box, not in bushels, but only in pint potsful, he made a great to do, and bemoaned himself, for he thought he was going to die absolutely from want. In his perturbation he betook himself to the grand castle of the powerful fairy Fiscalia, to beg her to help him.

But the fairy Fiscalia was totally and entirely subject to the influence of her former court chamberlain, a short and fat, grumpy and avaricious old man, named Doctor Agraricus, and he again was the godfather of Baron Gierschlung. Of course he gave him a very friendly reception, and when the Baron complained to him, with tears in his

eyes, that from sheer necessity he had only been able to have a coffee bath that day, and that if business continued to be so bad he would soon be compelled to grease his carriage wheels with common preserves, he promised most faithfully to say a good word for him to the fairy Fiscalia, so that she would be willing to give him assistance.

And so it was. When the old doctor laid the whole matter before the Fairy, her heart was filled with compassion, and she seized her magic staff, swung it round three times and uttered a spell to the effect that, wherever a sugar factory stood, a golden bounty-fountain should rise out of the ground, from which the sugar manufacturer might supply himself to his heart's content. And so it came to pass.

Then Baron Gierschlung was once more happy, and went home, and in the joy of his heart had oysters supplied to the manger of every horse in his stables.

But no long time after this his countenance grew sad again. For, in consequence of the magic spell of the good fairy, a whole lot of other people, not only barons, but even quite common townsfolk had set up sugar factories, solely on account of the golden bounty-fountain which sprang up at once close by and could not help but flow.

But because of this so much sugar was produced that very soon there were not half enough human stomachs in the world to consume it. And the golden bounty-fountain was no longer abundant enough to make good the loss to the manufacturers caused by so much needless sugar.

So Baron Gierschlung again betook himself to the good fairy Fiscalia. But when he stood before her, and she looked enquiringly with her great eyes, he had not a word to say. He would have been only too ready to beseech her to have the golden bounty-fountains dried up again for a time, so that the little manufacturers might come nicely to grief, and then the big ones would have been able to keep a-going without them, even though they only got the money by pints instead of bushels. But, as I have told you, he could not manage to get the words out, for he was afraid that, as an atonement for his having made a fool of the good fairy, she would be making him pay back again tenfold all that had unjustly come to him from the golden bounty-fountain.

Sorrowfully he returned home a broken-down man. For the greatest punishment is that which we bear within ourselves and of which we can say nothing to others.—(Translated from the Berlin *Ulk.*

GERMANY.

Provisions of the New Sugar Law of 31st May, 1891.

The following are the principal provisions of the Act, which is too long to be quoted verbatim:—

A tax of 18 marks per 100 kilos. (220½lbs.) = 8s. 7½d. per cwt., is levied on home-grown beet sugar entering into consumption, arrangements being made for its collection. The tax is payable on issuing from bond by the person who receives it for free disposal.

Sugar exported from bond is exempt from tax, but exported sugar which has been in free circulation does not enjoy any drawback.

Commencing with the 1st August, 1892, the duty on imported sugar is 36 marks per 100 kilos. (17s. 3d. per cwt.) on sugar, beet juice, masse cuite, or molasses. Foreign sugar intended to be worked up in a factory may be permitted by the excise officers to pay provisionally only the difference between the customs duty and the consumption tax, viz., 18 marks per 100 kilos., being afterwards treated as home-grown sugar in bond, *i.e.*, subject to the consumption tax if it passes into consumption, or free from duty if re-exported.

The new law comes into force on the 1st August, 1892. For all sugar produced up to that date, the present law is applicable up to the 31st October of the same year, subject to being under the fiscal control and kept separate until actually exported or stored in bonded warehouse.

Home-grown sugar produced up to 1st August, 1892, and passing into free sale up to 31st October, 1892, is only to be subject, so long as its identity is maintained, to the duty of 12 marks per 100 kilos.

Such sugar issuing from a customs warehouse, and having already profited by the drawback (reimbursable) belonging to the tax levied on the raw material, it will be subject to restitution of the drawback.

Commencing with the 1st August, 1892, and up to the 31st July, 1897, sugars exported or lodged in customs warehouses in quantities of at least 500 kilos. (half a ton) will enjoy a premium on the following conditions and in the following proportions:—

Class A.—Raw sugar, polarising at least 90° and under 98°.

Class B.—Candied, loaf, and other sugars, polarising at least 99½°.

Class C.—Hard sugar, containing not more than one per cent. of water, crystals, lumps, powder, &c., polarising at least 98°.

From the 1st August, 1892, to the 31st July, 1895:—

Class A......	1·25 mark per 100 kilos.	(about	7d.	per cwt.)
,, B......	2·00 ,, ,,	,,	11½d.	,,
,, C......	1·65 ,, ,,	,,	9½d.	,,

From the 1st August, 1895, to the 31st July, 1895:—

Class A......	1 mark per 100 kilos.	(about	5¾d.	per cwt.)
,, B......	1·75 ,, ,,	,,	10¼d.	,,
,, C......	1·40 ,, ,,	,,	8d.	,,

Sugar withdrawn from a customs warehouse to pass into open sale or to be transferred to a factory, will be subject to the restitution of the premium which had been granted on it.

BRAZIL.

Its Resources and Production.

A very interesting report on the "Resources of Brazil" has been issued by the United States Department of Agriculture. The reports furnished by this department are really admirable, and are, as a rule, much superior to anything official procurable in England, a fact which is not creditable to the greatest commercial nation in the world, though we certainly have to thank Lord Salisbury for a very notable improvement in the Consular Reports, both as regards the quality and the more recent date of the information.

In view of the great importance of Brazil, as the only great country of the world, excepting Africa, whose resources, as far as sugar is concerned, are practically undeveloped, the following extracts, obtained from the *American Grocer*, may be found useful for future reference:—

Roads and Railroads.

"The highways in Brazil, as in most parts of South America, scarcely deserve the name in most instances, and need no description. They do not extend far into the interior, and vehicles, except of the rudest kind, are seldom seen upon them.

"According to the report made by Senhor Valente, delegate from Brazil, to the committee on railway communication of the American International Conference upon the railways of Brazil as of January 1, 1888, that country had then in operation sixty-three railroads, aggregating 5,273 miles in length, which cost $190,705,163. In addition there are twenty roads in course of construction, 869 miles long, and twenty-five under survey, projected for 2,235 miles. The cost of building all these roads is given in this report at $300,291,819. The longest line extends 725 miles, in Sao Paulo and Minas Geraes, and the shortest, in Rio Janeiro, is but four miles long. The cost of the first was $72,104 per mile, and of the last $82,685.

Productions.

"The principal productions, and all those which enter into foreign commerce, are agricultural, excepting diamonds. Manufacturing upon a large scale is almost unknown, except that cotton manufacturing has recently begun, and mills for wheat grinding are in operation at Rio, using imported wheat. Coffee is the great staple product, exceeding all the others in value. Its production has steadily increased, and the rate of increase seems to have borne some relation to the progress made towards the extinction of slavery. In 'Brazil in 1889,' before quoted from, it is stated that from 1835 to 1840, while the slave trade yet existed, the total annual product equalled 88,000,000 pounds; from 1855 to 1860, when the slave trade had ceased, the annual product equalled 264,000,000 pounds; from 1872 to 1877, when emancipation by purchase was in progress, the product was 389,000,000 pounds annually; from 1877 to 1882, when the abolition propaganda was organised, it was 770,000,000 pounds, and since the abolition of slavery it has risen still further to 880,000,000. The area for coffee culture in Brazil is practically unlimited, and coffee and caoutchouc or rubber gum, her easiest and surest productions and most reliable articles for export, are of considerable magnitude in the commerce of the world.

"The latest available official report of the total exports of principal articles from Brazil, which shows her surplus production, was made by the Minister of Finance to Congress on the 6th day of May, 1887, for the three years ending June 30, 1886, and the figures, reduced to our weight and current values, are as follows:—

"*Official statement of the exports of principal articles of production of Brazil and values thereof during the fiscal years stated.*

	Years ended June 30.	Weight. Pounds.	Export Values. Dollars.
Coffee	1884	703,218,899	62,763,600
	1885	825,164,143	73,548,440
	1886	719,109,656	60,212,140
Sugar	1884	726,140,125	18,881,190
	1885	545,221,831	10,952,750
	1886	247,794,835	6,795,530
Caoutchouc	1884	20,176,499	4,564,450
	1885	17,425,158	5,126,080
	1886	18,044,651	5,515,940
Tobacco	1884	37,681,023	2,300,560
	1885	43,280,707	3,261,700
	1886	57,107,958	3,508,740
Leather	1884	23,505,445	2,124,930
	1885	22,702,971	2,478,120
	1886	36,966,733	3,655,420
Cotton	1884	72,057,351	6,145,120
	1885	53,582,803	5,280,480
	1886	33,188,048	3,124,670
Cacao	1884	9,274,752	1,103,960
	1885	9,953,769	1,146,420
	1886	9,228,456	1,046,060
Yerba maté	1884	12,138,528	426,530
	1885	9,572,373	330,030
	1886	32,381,165	1,105,890
Brazil nuts	1884	12,749,202	860,780
	1885	12,268,599	625,320
	1886	12,266,394	619,530

"Wheat as a paying crop on any large scale has disappeared from Brazilian agriculture.

FOREIGN COMMERCE OF BRAZIL.

"The latest available statement of the foreign trade of Brazil, with principal countries only, is that for 1888, given in "Trade and Transportation between the United States and Spanish America," by W. E. Curtis, prepared for the Department of State. In that publication the imports and exports are shown as follows:—

Countries.	Imports from Brazil. Dols.	Exports to Brazil. Dols.
England	26,177,259	39,654,720
France	22,538,478	21,112,617
Germany	7,260,722	13,321,412
Spain	5,680,821	8,316,811
United States	53,710,234	7,063,892
Total	115,367,514	89,469,452

"The total of this trade is $204,836,966, besides which Brazil received over $33,000,000 in coin from England, making the total of exchange over $237,000,000. Of the amount of imports from Brazil the per cent. of the United States was over 46·5, and of exports to Brazil shown in the table, about 8·3.

Commerce with the United States.

"The value of the exports of Brazil to the United States for the years ending June 30, 1880 and 1890, is shown in the following table, taken from the commercial returns of the Treasury Department. The named articles are all farm or soil products:—

Articles.	1880. Dols.		1890. Dols.
Coffee................	37,855,578	....	45,664,127
Hides and Skins	2,255,640	....	2,177,882
Caoutchouc	4,874,234	....	9,157,248
Sugar, brown	5,897,102	....	1,659,251
Wool, unmanufactured.	113,645	....	23,390
Other articles	973,891	....	636,858
Total..........	51,970,090		59,318,756

"The value of the imports of domestic products from the United States into Brazil during these same years was respectively $8,496,696 for 1880, and $11,902,496 for 1890. This shows an increase of Brazilian exports to the United States including and since 1880 of the value of $7,348,666; an increase of imports from us amounting to $3,405,800; and a total in trade between the two countries equal to $10,754,466. Our whole trade with Brazil was $71,221,252."

CANADA.

Sugar Production and Consumption.

Amongst the countries which consume the greatest quantity of sugar, Canada occupies a leading position. Certain statistics place this country next to England and the United States, and give Canada an annual consumption of 40 to 42 lbs. per head. In 1886, that of England was 72 lbs., and that of the United States 43 lbs.

The constant use in the dominion of Canada of hot beverages, such as tea and coffee, at all meals and by all classes, rich and poor, explains this consumption, which to a Frenchman appears very con-

siderable. Although a certain quantity of sugar is produced in the country, as we shall see further on, it is compelled to import the greater part of this valuable article. The countries from which this is derived are more especially the English and French Antilles, Germany (this is noteworthy), the United States, and England. France supplies, so to speak, none of it; the census of 1881 showed that of a total import of 30,000,000 francs (£1,200,000), France only sent the insignificant quantity of 4,275 francs (£171). In 1884, the imports of sugar and molasses into Canada amounted to 33,000,000 francs (£1,320,000), the quantities from the different countries being as follows:—

	£
The English West India Islands	398,000
The Spanish do. do. do.	237,800
Germany	94,600
United States	92,000
England	79,000
Other Countries	418,600
Total in round numbers	£1,320,000

As regards these figures, it should be pointed out that France and the French Antilles supplied, in confectionery and sugars below No. 9, only 6,600 francs (£264) worth.

We have stated that Canada derived the greater part of her consumption from other countries; she produces sugar, however, and it is interesting to look at her present and future production.

Present Production.—Canada produces maple sugar, especially in the Province of Quebec. The sugar is much liked by the people, and possesses, especially in the state of syrup, a delicate and agreeable taste, which recommends it to habitual consumers. The maple (*acer sacchariferum*) is regarded by the Canadians as a special gift of Providence; they have made it the national tree, and placed its leaf in the national coat of arms alongside of the industrious beaver. The maple, as is well known, has the peculiarity of containing a large amount of saccharine principles in its juice. This juice is obtained in Spring by tapping the trunk of the tree to a depth of from 1 to 1½ inch, and inserting a pipe, called *goudrette*, with a vessel underneath to receive the liquid.

The maple sugar is obtained in March and April, the quantity

being more abundant when the days are warm and the nights cold. A tree gives on an averages 110 to 120 litres (24 to 26 gals.) of syrup, representing 5½ lbs. of crystallised sugar. The tree does not appear to suffer from the treatment to which it is submitted, and M. Boussingault mentions a maple which, during 42 years, continuously yielded a quantity above the average.

The production of maple sugar does not appear to be decreasing. In 1881 it amounted to about 9,180 tons, of which the Province of Quebec alone contributed over 7,000 tons. This sugar is almost wholly consumed in the country, and the export to the United States is only inconsiderable. An estate possessing 3,000 trees gave, in 1890, 1,663 gallons of syrup, beside what was consumed on the farm, which sold at Montreal for 4s. per gallon. The best quality, however, is worth 5s. per gallon.

In the Province of Ontario the production is diminishing in consequence of the land being converted into pasture farms, but as a large quantity of maples have been planted during the past few years, the production will tend to increase.

Canada has been considering the question of the advisability of not remaining dependent for an indefinite period on foreign countries for her sugar supply, and in 1880 trial was made with the cultivation of sugar beets. At this date a French Company, with its centre and Committee of Directors at Paris, established a sugar factory at Berthier, between Montreal and Quebec. Experiments then made established the fact that the average yield in sugar was 12·17 per cent. with 80° quotient of purity. Further, the land was found to be adapted for the cultivation, coal and wood were cheap, limestone abundant, and bone-black could be had at a low price, in consequence of the abundance of bones. The conditions were thus most favourable, yet the company did not succeed. A distinguished statistician and public man, Mr. Gerbié, attributes the failure to three causes, which unfortunately appear to be really facts. These are:—

1. The want of a co-operation on the part of the managers.
2. The inexperience of the Canadian cultivators.
3. The insufficiency of capital.

We shall deal with the second reason, which is especially serious.

It is certain that the Canadian cultivator, at any rate, as a rule, does not as yet possess sufficient knowledge of the agricultural processes and the modes of working the soil required for the sugar

beet. There are special processes, careful surcharge, absolutely necessary manuring—the importance of which is not comprehended by the Canadian cultivator. For this cultivation there are further needed improved implements, the price of which is too high for the farmer. The consequences of such a position are at once evident. The sugar factory has to furnish seed and cultivating implements, and has to overlook the sowing, singling, weeding, hoeing, taking up, and other operations, all of which are very expensive, and sensibly adds to the cost of the raw material.

Other factories were erected a few years ago near Montreal, at Farnham, and at Coatticook. The former went to work circumspectly, but it will not be possible for some years to say whether it will be a success. The cultivator has to be educated and his agricultural knowledge must be developed by the practice of new methods.

The government of the province of Quebec has tried to further the cultivation of the beet, the importance of which it has foreseen, and has obtained from the provincial parliament a subvention of 2s. per ton on beets delivered at the factories. This is an encouraging premium, but it is too recently granted to have as yet produced any effect. Amongst the 30 cultivators who obtained prizes at the last provincial competition in Quebec, only 10 of them were beet cultivators. But to obtain proper results, the Canadian cultivator must first of all be convinced of the necessity of manuring his land, and learning practically the axiom that the earth never, unless under exceptional circumstances, returns otherwise than proportionately to what has been given to it. The agricultural journals are intelligently endeavouring to enlighten and instruct the cultivators, who are too much given to following the ways of their forefathers. The agricultural societies award prizes, the experimental stations publish accounts of trials with sugar beet cultivation which have been crowned with success; the government has lately nominated a commission to study in Europe, especially in France and Belgium, the best methods in use in the industry; the Prime Minister of the province of Quebec, Mr. Mercier, at this moment in Paris, will be able to judge for himself with regard to the improvements which will have to be made in the processes at present employed by the Canadian farmers.

We see then that a great effort is being made to develop the production of beet sugar in the country on a grand scale. It cannot be doubted that these efforts will produce happy results, for in the

province of Quebec, in Manitoba, and in Assiniboine there are lands of unquestionable fertility, which, properly treated, will produce sugar beets at a profit. In Manitoba especially, trials have been recently made, and the results obtained have induced a company of French Colonists, with the Count of Roffignac at their head, to establish a sugar factory which will be in operation next year.

The refining trade employed, in the province of Quebec, 493 persons in 1881, and the sugar turned out was worth £1,360,000. This industry has since made important progress. But the attention of the Canadian agriculturists must be directed to the production of home grown sugar, in the success of the sugar beet cultivation the country has a vital and leading interest.—*Journal d'Agriculture Pratique.*

CHAPMAN'S PATENT EVAPORATOR.

This apparatus, invented by Mr. Alfred Chapman, managing director of the well-known firm of Fawcett, Preston and Co., Limited, of the Phœnix Foundry, Liverpool, has been for some years favourably known to the public in connection with the supply of drinking water to the British troops at Souakin. Recent improvements, patented by Mr. Chapman, have resulted in its application with remarkable success to evaporating saccharine or other solutions or liquids by double, triple, or multiple effect. A primary desideratum in apparatus of this kind is to obtain free exit for the water resulting from the condensation of steam in the drums of the evaporating pans, without any loss of heat. This is effected by maintaining a continuous circulation of the condensed water through the various drums.

The many contrivances hitherto made use of have either involved the application of steam traps, which have been found to present many inconveniences, or of special pumps for removing and circulating the condensation waters and the solutions, or else these waters have been carried directly to a condenser, their flow into it being regulated by means of valves.

In the present invention, without employing any valves, pumps, steam traps, or other mechanism of any description, a regular and self-adjusting exit of the condensation waters is secured from each drum, all the heat contained in these waters that can be employed for

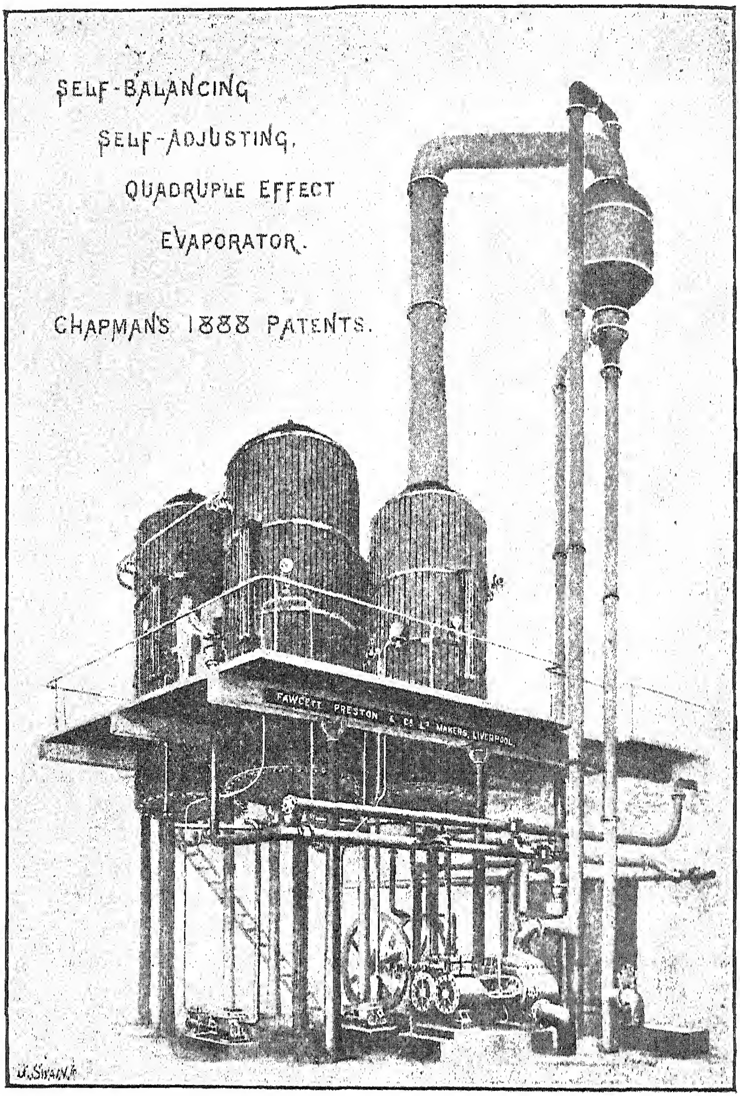
evaporation being at the same time utilised, and free and uninterrupted circulation from pan to pan of the solution or liquid under treatment being also maintained.

The following is the arrangement adopted for securing a free exit of the condensation waters from each drum :—

A pipe is connected with the bottom of the steam drum of the first pan at the place where the condensation waters would ordinarily come out, which pipe is carried down some 25 feet and then brought up so that it assumes the form of an inverted syphon. This is connected with the drum of the second pan below the pipe through which passes the steam from the juice in the first pan. By means of this syphon the waters of condensation from the first drum are conveyed into the second, where the heat contained in them is utilised. A similar syphon connects the second and third drums, and so on for any number of pans.

For the purpose of maintaining a free and uninterrupted circulation through the pans of the liquid to be evaporated, a similar system of inverted syphons of suitable lengths and diameters is adopted. By this simple means a complete and uninterrupted circulation, on the one hand of the condensation waters, and on the other of the liquid to be evaporated, is obtained, without the use of any regulating valves, steam traps, or mechanical contrivances, whilst at the same time the pressures in the pans and drums regulate themselves automatically. The waters of condensation are removed from the last drum by means of a condenser or pump.

The system of the inventor admits of easy application to existing apparatus, modifications being made according as circumstances require, but the principle adopted for maintaining the circulation of the juice remains the same, and the most striking and valuable feature of the system, next to the economy of fuel secured, is its extreme simplicity, in dispensing with all the more or less complicated appliances hitherto employed, and uniting the pans by means of suitable syphons, in such a manner as to secure, on the one hand, an automatic continuous circulation, through the whole apparatus, of the waters of condensation, their heat being fully utilised, and, on the other, a similar circulation of the liquid under treatment, which only traverses the tubes without remaining in them. There are only two valves to regulate; those which control the supply of juice and of steam to the first pan.



We are glad to be able to give an illustration of one of the latest forms of the apparatus, and think the description already given above will be best supplemented by a quotation from a notice contained in

The Engineer, which last April sent a special reporter to examine a plant which was being put together for a sugar works in South America, to evaporate 3,500 gallons of *water*, or (say) to treat about 5,500 gallons of cane juice, per hour.

"One special feature is that by the construction of this apparatus no portion of the juice can be exposed a second time to the action of the heating surface in the same pan, but all must flow upwards and once and for all in each pan, passing away immediately to the next pan or to the syrup extracting pump, as the case may be. Thus, there is no fear of any inversion taking place, as the juice is exposed to the action of the heating surface for a minimum of time, and consequently an increased amount of sugar is obtained from a given quantity of juice. Economy in steam is also achieved by the simple expedient of making the condensations from the drum of the first vessel pass to the drum of the second vessel, and so on through the series, thus thoroughly utilising the heat in the condensations without interfering with the respective pressures in the drums, as the circulation of the condensations is carried out in precisely the same way as the circulation of the juice.

The latest arrangement adopted is that of a quadruple-effect evaporating plant, in which improvements have been carried out so as to afford greater facility for control, whilst at the same time it occupies less space. In previous apparatus the vessels have been arranged in a straight line, but by bringing the first and last vessel of the series side by side, the attendant in charge can manage the whole apparatus without moving from the two pans, as he can regulate the steam valve and feed valve at the same time that he is watching the density of the liquor flowing from the last vessel. To facilitate this latter operation, a very simple appliance has been designed, by which a constant flow of syrup from the last vessel is passed through a receptacle containing a *pèse sirop*, so that the density of the syrup can be ascertained at any moment by merely looking at the apparatus. The results obtained in actual work have abundantly demonstrated the striking efficiency of this system, not only as regards new apparatus constructed on it, but also as regards its application to existing apparatus. Since its introduction in 1888 the new evaporator has been and is being largely adopted for evaporating the water from cane juice in sugar factories; from the spent black liquors in paper mills

containing soda ash, and in distilling pure water from sea water and other purposes. For these purposes fourteen new apparatuses, we are told, have been, or are now being delivered of the triple and quadruple-effect types, and having an aggregate heating surface of over 57,000 square feet, whilst during the same period nine existing multiple-effect evaporators, of an aggregate heating surface of 36,000 square feet, have been converted to the new system in the West Indies. Contracts are now being carried out in the works at Liverpool for adding evaporating vessels of the new or Chapman system, as it is called, to existing multiple-effect evaporators on other systems for paper and sugar work purposes, and at the time of our visit the drawings were being prepared for a very important installation of this system for distilling fresh water from sea water. The chief points of merit in the apparatus, the makers claim, consist in the admirable circulating arrangements by which the heating surfaces are kept clean and efficient, the automatic manner in which it regulates itself to varying conditions of work, and the precautions taken to prevent any loss of heat, either latent or sensible, in order to secure economical evaporation. In proof of this we were shown certificates from users of both new and converted evaporators. One of these was from the manager of the Hendon Paper Works, Sunderland, where an apparatus has been at work since the latter portion of 1889, in which evaporation equivalent to thirty-seven tons of water per ton of coal used is being carried on, and writing on the 14th April, 1890, in reply to an enquiry on the subject, this gentleman said :—'I have never had to touch the tubes since the first day—7th November, 1889—your apparatus was set to work. I had the first and fourth vessels personally examined four weeks ago, and, as far as could be seen, they were as clean as when they came from your shop.' Another, the latest received, was from a Cuba sugar planter, and testified to an increased power of evaporation of 50 per cent. having been obtained during the last crop in the triple-effect apparatus, made in Paris, and existing on the estate, by the addition of the patent circulators, a result which has also been equalled on several estates in Demerara on apparatuses of Scotch and English manufacture."

The application of this system to existing apparatus has already been very favourably noticed by Demerara papers, and by the *Propagateur de la Martinique.* As regards new constructions, the

triple effect at the Uitvlugt Estate, Demerara, constructed by the firm of Fawcett, Preston & Co., Limited, and the quadruple effect at Providence Plantation in the same colony, both on the new system, are working with exhaust steam, the pressure of which never exceeds 5lbs., and are giving complete satisfaction.

The apparatus at "Los Canos" and "Ysabel" plantations in Cuba, constructed some years back, the former in Paris and the latter in Glasgow, have been converted on Chapman's system, and are working most satisfactorily. In the case of the former, the plant, before conversion, was able to treat 2,200 gallons of juice per hour, while, since conversion, it has worked up to 3,300 gallons per hour, and could not be kept sufficiently supplied with juice.

At the present moment the Liverpool firm have orders on hand for converting seven old style apparatus to this system in Cuba alone.

AUSTRALIAN SUGAR PRODUCTION.

We give below a further extract from an article on the above subject (a portion of which appeared in our issue of last month) taken from the *Year Book of Australia, for 1891*, which may be obtained from Kegan Paul, Trench, Trübner & Co., Limited, London:—

So far back as 1824 experimental sugar cultivation was successfully attempted at Port Macquarie, New South Wales, where 600 acres were planted with cane, and the returns therefrom proved satisfactory; no further systematic effort was made, however, to extend the cultivation of sugar until 1863. From various causes the Port Macquarie plantation was allowed to fall into neglect, and so recently as 1862, sugar cane was to be found only in public or private gardens, where it flourished solely in the interests of botanical science, or simply as an agricultural curiosity. The agricultural records of New South Wales show that in 1863 there were in that colony only two acres under cane, but the area became gradually extended until in 1870 it embraced 4,082 acres; of which 1,475 were productive, and 2,607 non-productive. The quantities of cane or sugar obtained therefrom were not given until 1876, when the area under cultivation had increased to 6,755 acres, of which 3,524 acres were productive, and 3,231 acres non-productive. The quantity of cane obtained in that year, from the productive area, was 99,430 tons. The area continued to increase until, in 1884, it reached 17,517 acres, of which

only 6,997 acres, however, were productive, as against 7,583 acres during the previous year. The quantity of cane also showed a diminution, falling from 204,547 tons in 1883, to 105,323 tons in 1884. In 1885 the productive area had become increased to 9,583 acres, and the quantity of cane to 239,347 tons, this being exceeded only in 1887, when an exceptionally favourable season enabled growers to obtain 273,928 tons of cane from the diminished area of 8,380 acres of productive ground. The latest returns show that in 1889 the total acreage under sugar cultivation in New South Wales, was 18,730 acres, of which 7,348 acres were productive, and 11,382 acres non-productive; the total yield of cane obtained from the same, being 168,862 tons. The productive area represents that on which the cane was cut during the season; while the non-productive area is that on which the cane was unfit for crushing, or allowed to stand over another year.

The principal centre of the New South Wales sugar growing industry is the Richmond River district, where (according to Mr. Coghlan, the Government Statistician of the colony) there were, in 1889, 529 holdings, upon which areas, varying from 2 to 520 acres in extent, were devoted to sugar cane culture. The total area so planted in the Richmond River district, was 11,410 acres, or over three-fifths of the whole area under cane in the colony, the average yield from the 4,260 productive acres, being 20·06 tons per acre. The Clarence River district ranks next in importance to the Richmond River district, the aggregate area under crop being 7,150 acres, of which 3,035 acres were productive, giving a return of 81,970 tons, or an average of 27 tons per acre. A small quantity of cane is grown also on the Macleay River, but the extension of the sugar-growing industry in this part of the colony is greatly retarded by the deficient means of intercommunication.

In Queensland, sugar cultivation was first attempted in 1839, when a few acres near Moreton Bay were planted with cuttings obtained from the Mauritius. The results of the experiment were encouraging, but although it was ascertained that many portions of the coastal districts of the colony were admirably adapted for sugar cultivation, it was not until 1865, or two years after a start had been made in New South Wales, that any practical attempt to introduce the cane-growing industry was made. Two years later, in 1867, there were in Queensland six mills, the crushings of which resulted in the pro-

duction of 168 tons of sugar and 13,100 gallons of molasses. In 1880 the area under cultivation was 20,223 acres, of which the product from 12,497 acres, (after crushing) gave 15,681 tons of sugar. The area under cultivation continued to increase annually until 1885, when it reached 159,186 acres, of which 38,557 acres were productive, yielding 55,796 tons of sugar. In 1886, an exceptionally favourable season enabled 58,545 tons of sugar to be obtained from a diminished area (34,657 acres). In 1887 the productive area became increased to 36,806 acres, furnishing 60,807 tons of sugar; but the following year (1888) beheld a serious fall in the rate of production, 34,659 tons only being obtained from 32,375 acres. An improvement was perceptible in 1889, when the produce of 29,438 acres amounted to 40,169 tons. In 1890 the improved rate of production was maintained, but operations were, and still are, considerably impeded by the deficiency of suitable labour. Taking the returns of the last ten years as a basis of calculation, it is found that the lowest average produce per acre (0·98 tons), was in 1882; and the highest (1·69 tons) in 1886.

The uncertainty of the crop (the quantity of cane and the quantity of juice per ton being larger in some years than others), together with the dearness and scarcity of suitable labour in Queensland, form the principal difficulties with which the Australian sugar industry has to contend, but they are not insuperable, as shown by the steady progress in the rate of sugar production.

In New South Wales, the price of good white sugar was from £25 to £26, in January, 1890; rising from £26 to £28 in February; to £29 in March; and £30 in April; and subsequently falling to £26 to £27 in June; to £25 in July; and to £24 10s. in September, which remained the average price during the remainder of the year. In Victoria prices were considerably lower, the bottom prices being £23, and the highest £27 10s. This was a result of the large imports from Queensland and Fiji, which now seem to keep pace with the increased consumption.

Should the Queensland sugar planters be enabled to overcome the labour difficulty, which has so frequently paralyzed their efforts, the already large output of the Colonial Sugar Refining Company in Queensland, New South Wales, and Fiji, would increase indefinitely, and assure to the company the virtual control of this market, and discourage shipments from all other producing countries.

THE SUGAR INDUSTRY AT THE PRAGUE EXHIBITION.

We have received two exceedingly interesting pamphlets, entitled *Entwurf einer Geschichte der Zuckerindustrie in Boehmen, Erste Periode*, 1787-1830, pp. 104 (Historical Sketch of the Sugar Industry in Bohemia), and *Beitraege zur Geschichte der Zuckerindustrie in Boehmen, Zweite Epoche*, 1830-1860, pp. 172 (Contributions to the History of the Sugar Industry in Bohemia), by Messrs. K. C. Neumann and Joh. V. Divis, respectively, together with a smaller pamphlet by Mr. A. Horinek, the Business Manager of the Bohemian Sugar Manufacturers' Union, the latter containing a series of valuable statistical tables of almost everything relating to the beet cultivation and sugar industry of Bohemia.

For these very useful and carefully compiled productions, we are indebted to the courtesy of Herr Hugo Jelinek, who has added a small brochure explanatory of the Historical Exposition which is now open for inspection, from which it appears that the original conception of giving an idea of the rise and historical development of the Bohemian Sugar Industry by actual machinery, or at least models of all the appliances known, had to be abandoned, as presenting insuperable difficulties, in favour of pictorial representations supplying, as fully as has been possible, the place of the machinery and models, forming undoubtedly a most instructive collection.

As regards the pamphlets, or rather books, mentioned above, we should have liked to give some extracts, but space and time forbid. Should, however, any of our subscribers desire the loan of these very interesting publications, we shall be happy to oblige them.

CENTRIFUGALING HOT *v.* CENTRIFUGALING COLD.

Difference of Results.

A short time ago an esteemed correspondent asked us to give some information, if possible with reliable figures, respecting the comparative results of sugar yield obtained by centrifugaling hot or cold, which he suggested would be of general interest. Having consulted two practical men who have had experience both in the beet and cane sugar industries, the latter in the West Indies, we have received the replies given underneath, which represent the best available figures. The question of larger or smaller gain in sugar seems to be sub-

ordinate to that of what sugar is required to be produced, hence it is not easy to get tabulated comparative figures as to the difference in yield between centrifugaling hot from the pan and either waiting for the mass to cool or cooling it artificially before putting it into the centrifugal machine. The following is the first reply received:— "The masse-cuite ought to be worked up cold if grey sugar (for refining purposes) or white sugar has to be made; but if yellow crystals are desired to be made, the previous cooling down produces a nasty grey colour. The gain in curing cold is considerable. Experiments which I made myself showed from 5 to 8% in favour of cold curing. In Cuba, however, where most of the factories cure cold, the gain is considerably more. Of course if you make "Demerara Crystals" there is no ultimate gain. Another advantage of curing cold is that you get very little second product, and therefore less room, steam, labour, &c., are required. I do not think anything has been published up to now with regard to comparative gain or loss in working cane sugar—at any rate, nothing reliable has appeared."

The second communication, from Trinidad, is as follows:—

I may commence by stating that I have never, in any country, met with such high yield of sugar in proportion to the quantity of the charge as in Germany, where, as is well known, the centrifugaling is done cold; so cold that the mass, treated with CO_2 or compressed air, issuing from the boxes (containing from two to four cwt.) comes out in a pyramidal form, having the appearance of yellow marble.

In Holland, also, I found that the endeavour is to work at a low temperature, yet the economical people had not been able to make up their minds to the expense of procuring hundreds of small boxes, but used the same large boxes as those employed for centrifugaling hot. Naturally it was a difficult task in this case to turn out the solidified mass.

In the neighbouring country of Belgium, the idea is also to work at as low a temperature as possible, but this small industrial country, so ready to adopt every new invention, possesses a great variety of arrangements for properly cooling the mass, among which may be mentioned that for stirring in horizontal box-shaped chests, by means of which the mass, while kept in continual movement, is cooled by a stream of water and then conveyed to the centrifugal.

The principal aim in the cooling process is the obtaining of a high yield; it is mostly adopted in the raw sugar manufactories, where a

polarisation of 97° to 98° is the maximum desired to be obtained. On the other hand, if the production of unbroken and perfectly white crystals is the object, as was almost universally the case (when I was in France) with the manufacture of No. 3 sugars, then the separation of the sugar from the syrup is proceeded with very shortly after the boiling has ceased, and the fairer appearance and hence greater value of the product makes up for the smaller yield. In this method the construction of the *malaxeurs* or . . . . is naturally much more simple, and not unfrequently Archimedean screws are employed as a cheap means of conveyance for the mass.

These few details will give you my ideas on the subject, but to complete my statement, I will add the results of the experience gained during the working of two crops in the Antilles.

In this case also I have found my view confirmed, that in order to get a fine large grain of good colour and quality, such as is required by the merchant, it is necessary to delay the centrifugaling of the syrup for some little time, though not too long, which has to be done under the supervision of an experienced and skilful sugar boiler. For the sake of comparison, I have tried working both hot and cold, but am unable to supply any accurate figures as regards yield, because there is not at present any arrangement for weighing the charge before mashing. I have, therefore, until next season, to apply the uncertain method of volumetric computation to the large boxes containing from 80 to 90 hectolitres, and obtain approximate results by ascertaining the specific weights. According to this method, we got some 3 per cent. more sugar by cooling down to about 104° F.

It appears to me most advisable to centrifugal hot in making the so-called "Demerara Crystals," because the juice and syrup require to be treated with a neutral or preferably slightly acid re-action, and hence if the centrifugaling is delayed the danger is incurred not only of increasing the co-efficient of invert sugar, which is already sufficiently high, but of facilitating fermentation. I may remark that I have found that this danger may be almost entirely avoided, by again treating the cane juice (which has already been sulphured and cleared) with SO_2 up to neutrality on its second clarification, in order to precipitate certain line compounds, and make it more easy to filter in cotton presses. In this case sulphurous acid serves, be it understood, not as a bleaching but as a precipitating and antiseptic agent. In

addition to this, I have found that the subsequent filtration of the syrup, with previous phosphate of lime clarification, is better effected than when the treatment with SO_2 is omitted.

It is, of course, understood that I have for this purpose a well-constructed sulphur oven, pump for compressed air, and closed saturation box, with lead pipes, and—last, not least—that I have at command a completely fitted-up laboratory for carrying out the exact chemical supervision necessary in these processes.

THE DIFFUSION PROCESS IN CUBA.

By GEO. STADE.

Compiled from information obtained from the "*Revista de Agricultura*," &c.

In conformity with the reserved attitude adopted in regard to the Robert Diffusion Process by the *Revista de Agricultura* during the past year, that journal refrained from any detailed critical notice of this method of extraction. The reason for this reserve was the desire to wait until it had been sufficiently long in operation to give an opportunity of forming a definite practical judgment on the working of the process.

Now that the batteries which were set up in 1890 at the Central Factory of San Joaquin have been dealing with the crop of this plantation since the beginning of January in a regular way, the *Revista* is now in a position to deal with a working period of more than two months. It is now fairly established that the batteries are doing their work faultlessly, without the slightest interruption, without requiring repairs or any other suspension of work, and also with such ease and wonderful perfection, that the working of the apparatus really leaves nothing to be desired.

The perfect interworking of the whole machinery is really astonishing. It is not intended to give any description of the entire plant, but mention must be made of the remarkable regularity of the working of the cutting machines and the intermediate machines. There is indeed no need to fear any comparison with the newest and best appointed mill-factories. The canes are converted with no interruption into slices of $\frac{1}{15}$in. diameter. The conveyance of these to the tanks is effected automatically, and the preparation of the canes takes place with mathematical regularity. In this connection, the diffusion-plant at San Joaquin is the largest in the world used in cane sugar manufacture. The Magnolia Factory in Lousiana, the

property of Governor Warmoth, worked up, according to the last report, about 400 tons of cane per day, while San Joaquin, as far as the slicing machines and batteries are concerned, could deal with 90,000 arrobas of cane, = 1,035 tons in 24 hours. But from other causes the maximum of work is not attained, for the number of hands on the plantation, as well as the steam apparatus of the factory, are quite insufficient for this. An average daily quantity of 460 to 510 metric tons (9,200 to 10,200 centner) is, however, dealt with without any difficulty, whilst with a sufficient supply of cane 57,000 arrobas=655 metric tons (13,100 centner) was passed through the diffusers with equal ease.

These figures sufficiently indicate the character of the prophecies which, without any foundation or reason, were made last year in many quarters in Cuba respecting the Robert Diffusion process. And all the other assertions, proceeding from superficial and fanciful critics destitute of any technical knowledge, are contradicted by the facts. Figures are the best proof—and in the present case they show quite clearly, that diffusion is not merely a laboratory pastime, but in spite of all the inevitable "appendages" such as cane-slicers, elevators, &c., has turned out perfectly practicable on a large scale, without there having been the loss of a single quarter of an hour with all its apparent complexity.

The removal and disposal of the bagasse, which last season, with a much smaller daily average of work, was only effected with difficulty, is now perfectly regular. It may be remarked that at San Joaquin they have preferred not to burn the wet bagassé, last season as other cheap fuel is abundantly procurable. The disregard of the chips as fuel, however, would not be everywhere justifiable, and least of all where wood is not to be had and coal is too dear, all the more so when we reflect that it is quite possible to produce sugar without burning a cubic yard of wood or a ton of coal. With a proper modern plant of machinery the diffusion chips undoubtedly supply sufficient fuel for the manufacture of all the products. At the same time the special usefulness of the bagasse as manure, respecting which there is no doubt, must by no means be underrated. After all it is only a question of money where the *pro* or *con* can without difficulty be settled by calculation. At San Joaquin the bagasse is spread on the fields, and this is so arranged that no large quantities are stored up in the yards of the factory.

The batteries work, as has been said, faultlessly, the staff being

thoroughly instructed. The clarification of the juice takes place in the battery itself, the same was already the case in 1890, and promises to be a regular thing. In Hawaii, during the campaign of 1889–90, the juice of about 46,000 tons of cane treated by diffusion was clarified in the battery alone to universal satisfaction. At San Joaquin the clarification was further completed in the *messgefässen*, and on passing from the latter the juice runs through mechanical filters to the steam apparatus, so that, as a matter of fact, a double clarification takes place, and the result is an excellent liquor.

The extraction in battery No. 1 in February went as far as to 0·38 per cent. of saccharose; in battery No. 2, at the same period, the saccharine content of the slices, after treatment, was 0·58 per cent. As the average saccharine content of the cane during the time mentioned was 13·63 per cent., this is equivalent to a total loss of saccharose of respectively about 2·7 and 4·3 per cent. of the sugar in the cane. These data agree exactly with those which have been received from other countries.

It may be further mentioned that the sugar obtained is of excellent quality and high polarisation.

The journal from which these details are obtained closes with a summary which will be carefully studied at any rate in the West Indies, but also undoubtedly elsewhere; it is all the more interesting because hitherto the leading specialist journals have not had the courage or the technical insight to openly espouse the cause of diffusion—probably not wishing to come into collision with the so-called "authorities," who up to now are still strongly in favour of heavy mills. All the more important is the fact that the most influential journal, conducted by an expert in these matters, of the most flourishing and, for the sugar production, most important colony, the official organ of the planters and landowners of Cuba, now takes up a clear and decided position.

The dictum as regards diffusion is sufficiently remarkable, and is as follows:—

> 1. The diffusion process is perfectly and practically introducible into the routine of cane sugar manufacture. It works regularly and without difficulty, and permits the extraction of the sugar from the slices to be carried to the extremest limit, without bringing with it the dangers which mills of every construction always sensibly involve—with equal amounts of work—to the stability and safety of the machinery.

2. The proceeding is equally well adapted for smaller works as for the largest central factories.

3. Diffusion has now made its entry into Cuba as successfully as it has done into Louisiana, Java, Spain, the French and English colonies, Hawaii, &c. It works in the central factories as safely and accurately as the best mills.

Last year the *Revista* already went so far as to assert that the future of the cane sugar industry of Cuba depended on the success of the Robert Diffusion system.* The journal now repeats this declaration, with the remark that the question has now been decided practically. The brilliant success of the process has taught us that nothing but modern methods of working are now admissible. At the present moment, when the principal industry of the island is passing through a severe political and financial crisis, on the outcome of which depends the existence or extinction of the greater part of the sugar manufacturers, it is absolutely necessary, to become acquainted as early as possible with all the appliances which will enable the manufacturer in future to increase the yield, and reduce the manufacturing expenses. But all these ways and means are concentrated in Diffusion, the introduction of which is to be recommended in every case where its adoption is realisable from a technical point of view.

Inasmuch then, as according to competent judgments the preliminary conditions for the adoption of diffusion are laid down for about half the plantations in Cuba, it is an unmistakable fact, that an advance in the technical working of the "ingenios" is only a question of time. Although it cannot be denied that for the moment the state of political affairs renders difficult a rapid advance of the industry, and although the defective administration which is permitted in the "Pearl of the Antilles" to an incredible extent by the mother country—together with a total want of intelligence respecting the true weal and woe of the country—and everything is put in motion to hinder free action, yet progress will before long make a way for itself. The active and restless North Americans will of themselves look after this, for they are trying to get hold of one plantation after another, and already some fifteen per cent. of all the sugar is being produced by them.

* The writer has already long ago expressed his opinion on this point. See "The Diffusion Process applied to the Sugar Cane—A Fact" (*Sugar Cane*, 1885, p. 327, &c.) This article was very keenly discussed at the time, though very little to the point.

DIFFUSION OF THE CANE AND THE BAGASSE.

(From the *Sucrerie Indigène.*)

In Demerara, two out of the three diffusion plants set up last year have not been used for the 1890 crop, and the system of double crushing has been reverted to.

In Cuba also the same thing has occurred. The reports of the results of direct diffusion of the cane in that island are very contradictory. One thing is certain, viz., that the Montana and Caracas estates, on which diffusion installations were set up last year, have worked this year with the mill only, which induces us to think that their proprietors find the latter process of extraction the most profitable.

Apropos of the diffusion of the bagasse, in opposition to that of the cane, a correspondent of the *Louisiana Planter*, Mr. Peter Collier, has referred to the conclusions arrived at in the report of Professor Wiley on the working of diffusion applied to the bagasse, at Torre del Mar, in Spain. Comparative experiments with regard to diffusion were made during the two halves of the crop of 1884. The result of these was that the diffusion of the cane was abandoned, in favour of that of the bagasse. The determining reason was that the juice of diffusion cannot be suitably defecated by the ordinary processes, and requires apparatus for carbonatation. Mr. Wiley says:—"The juice of diffusion does not contain a sufficient proportion of albuminous matters to admit of a good defecation."

In another place Professor Wiley states that the result of analyses is to establish the fact that the proportion of glucose in the diffusion juice is less than in the mill juice, "which," he adds, "is a truly surprising fact." Mr. Wiley says finally that his visit to Torre del Mar has led him to modify the first conclusions of his report of December, 1884, in which he deprecated strongly the diffusion of the bagasse. He thought at that time that carbonatation would be indispensable in the treatment of this juice. He is now convinced of the contrary, and thinks that he may safely recommend the Louisiana planters to make a trial of the diffusion of the bagasse.

Since then, Messrs. Herwig & Boyer, by means of a very simple and inexpensive apparatus, have obtained results equal, as regards extraction, to a good diffusion, retaining also in the juice its superiority over that resulting from the direct diffusion of the cane.

DIFFUSION *v.* MILL.

Our readers are aware that details of the last season's working of the diffusion plant on the Britannia Plantation of the Oriental Bank Estates Co., in Mauritius, have appeared in most of the leading sugar journals in the world, based chiefly on a report by M. Faymoreau, and in several cases accompanied by comments and predictions indicating the speedy and inevitable replacement of the old crushing-mill system by diffusion. That this eventuality is not so near as many of the more or less interested advocates of diffusion naturally are prone to predict, and that the question is by no means so nearly settled as many choose to assume it, is an opinion which we have always maintained and which we consider warranted by the facts which have come under our notice, and we shall not be surprised if the ultimate result should be that each system, in virtue of its own special merits, is more adapted in a given part of the world than the other, the mill system of the most improved type holding its ground in certain quarters, and being replaced in others by a more or less modified form of diffusion. Amongst the journals which gave prominence to M. Faymoreau's remarks was the *Journal des Fabricants de Sucre*, and these have elicited from Sr. Eduardo Claudio, of Rio de Janeiro, some very interesting comments in a letter of which we append a translation:—

Rio de Janeiro, May 5th, 1891.

To the Editor,

I take the liberty of requesting you to be kind enough to publish in your journal some remarks on the subject of the article of M. A. Faymoreau, "*La diffusion à Britannia*," published in your issue of 18th March last.

Is the cane sugar industry really condemned to perish if it does not adopt the diffusion system? We are told that diffusion has been the salvation of the French industry; is not this rather a consequence of the salutary law of 1884? I prefer the latter supposition; as a matter of fact, it is not indispensable for the advancement of our industry that there should be a radical change in the manner of extracting the juice from the cane. I believe it would be more reasonable for us to improve the cultivation and to extract the juice more economically than can be done by the diffusion process.

This is what I propose to endeavour to prove.

At the "Alma" sugar works the canes have been giving a yield in proportion to their saccharine richness, the progressive yield having been as follows:—$\frac{12 \cdot 26}{8 \cdot 17}$, $\frac{12 \cdot 60}{8 \cdot 40}$, $\frac{12 \cdot 62}{8 \cdot 41}$, $\frac{12 \cdot 88}{8 \cdot 55}$; that is to say, the cane between 14 and 16%, or averaging 15%, would give 10%. How is it that at Britannia they have only got 8·25%?

If we admit a yield of 10% with double pressure, the difference would only be 1·34%, which would be more in accord with the opinion of Bonâme.

We may be permitted to have some doubts where there is no formal *in extenso* statement published of all the expenses connected with the two systems, with the corresponding analyses of the juice, syrups, masse-cuite, and molasses. We have left far behind us the time when it was sufficient to say "*magister dixit.*" Manufacturers are very hard of belief, and we may admit they are right in so being; for here we have been told for many years that diffusion was working wonders, that its superiority was evident, and we are still in the experimental stage (*sic*). Is this really the best way to make us believe it infallibly sure?

To return to M. de Faymoreau's article, let us see what is the result of diffusion at Britannia.

At these works, with 15 to 18 hours working with the mill system, there were obtained 18,000 kilogr. (say 18 tons) of sugar, and during the trial period of diffusion, with 24 hours' working, with nearly double the staff, burning coal in two out of the five boilers, the total production was only 18,375 kilogr., and this with a maximum yield of 12·25% in sugar; this grand result is incontestible, and they say diffusion is a wonder!

Britannia, says M. de Faymoreau, the production of which was 2,000 tons of sugar, will thus make 3,000 tons from the same quantity of canes, burning 2,250 tons of coal; the increased receipts will be 480,000fr. for an increased expenditure of 18,000fr.; grand business, apparently. But 2,250 tons of coal at Mauritius come to exactly 180,000fr. We, therefore, have to add the extra cost of labour, the interest and sinking-fund charge for the capital, and the keeping up of the new plant, and, after all, we have to deal with the evils inherent in evaporating apparatus.

The example, which M. de Faymoreau cites in support of his preference for diffusion, is not one of the most happy ones. It is as follows:—There are at present in the Sandwich Isles two important

works close to one another, where the conditions are the same, one working with diffusion and getting 11·5% of sugar, and the other by double crushing, with maceration of the bagasse, which gets 10% of sugar. The *Journal des Fabricants de Sucre* of the 1st April, in an article "La Canne aux îles Sandwich," informs us that Mr. Young has got 14·5% of sugar with the mill, and the Kealia Factory has almost *(sic)* attained this yield with diffusion. Commentary is, I think, needless, but people will probably think with me that mill-juice is not more difficult to work than that of diffusion.

Whilst trials are being cautiously made with diffusion, all the time making believe that it is already a process fully introduced, the diffusion of the bagasse is being applied elsewhere with much success, 10·85% of sugar being obtained; this more simple operation, and more economical in its first application, is not the best to adopt under the present condition of sugar manufacture, inasmuch as, with slight modifications, as I shall proceed to prove, while keeping to the old system of working, as good results can be obtained as with the regular methods of diffusion.

The bagasse on issuing from the mill still contains unbroken cells full of juice, and juice adhering by capillary attraction. A second crushing has been employed to extract the remaining juice, but it is evident that without previous preparation the second crushing, taking place under the same conditions as the first, would produce only insignificant results.

What is the general method of procedure? A little water and a little steam are added, and the bagasse, thus prepared, is *immediately* passed into the crushing mill. Now, is this a reasonable way of acting? What other action can the hot water have than to dilute the juice which is held back owing to capillary attraction. Time is required for the cells which have not been cleared to profit by the treatment.

In order to be able by the second crushing to extract economically nearly all the juice, it is necessary to sprinkle the bagasse liberally with boiling water, to leave it in the steam some four or five minutes, and only then to subject it to the second crushing. Only try this as I have stated it and the result will be perfect; and it is very easy to do when crushing is going on.

Time, which here is not so costly, is required for the osmotic action between the boiling water and the juice in the cells; in the same way

they used to work with 16 diffusors, they work better now with twice eight, and do more work; what is the important factor in this system? it is the time, since the rapidity of circulation only counts for half in this case; why should we not avail ourselves of this circumstance in using maceration before second crushing.

Let us see the result of good maceration :—A cane composed of

$$\left.\begin{array}{lr} \text{Water} \ldots\ldots & 74 \\ \text{Sugar} \ldots\ldots & 16 \\ \text{Woody fibre} \ldots\ldots & 10 \end{array}\right\} = 100$$

would give on the first crushing a juice containing 56% of water and 12% of sugar,* and a bagasse containing water, 18%; sugar, 4%; and woody fibre, 10%.

This bagasse watered with 25% of water will then contain water, 26%; sugar, 4%; woody fibre, 10%.

In double crushing we shall have: In the first case, 65% :—juice containing water 22·54, and sugar 3·46, = 26 and bagasse containing water 3·46, sugar 0·54, and woody fibre 10, = 14,

In the second case, 60%: juice, containing water,* 3·20; sugar,† 20·80 = 24, and bagasse, containing water, 5·50; sugar, 0·80; and woody fibre, 10 = 16.

In the first case of double crushing, we should have :—

Water	22·54 +	56·00 =	78·54
Sugar	3·46 +	12·00 =	15·46
	26·00 +	68·00 =	94·00

In the second case :—

Water	20·80 +	56·00 =	76·80
Sugar	3·20 +	12·00 =	15·20
	24·00 +	68·00 =	92·00

Calculating as above, and varying the quantity of water of maceration and the successive crushings, according to the degree of exhaustion desired, and not forgetting the factor of *time*, we shall obtain results industrially superior to those obtained by all the other processes. And do not forget that *time is money*.

(Signed,) EDUARDO CLAUDIO.

*I have got a juice of 70 and 72 per cent. with rollers fitted with hydraulic pistons at a pressure of 1,000 kilogs. per centimetre of length.

† Note by Editor *Sugar Cane*: The figures here are evidently misplaced in the original.

BARBADOS.

We give below an extract from a letter to the *Barbados Agricultural Gazette*, entited "Leaks and Losses." If the state of things is anything like what is there represented, then we may be sure there are other reasons than low prices and competition of beet sugar why sugar planting does not pay. Experimental stations are undoubtedly valuable, perhaps indispensable, but they will not supply common sense.

"I have read the letter in your contemporary, *The Reporter*, signed X.Y.Z., in which reference is made to the Petition sent by the Agricultural Society to the Governor asking that certain estates in the highlands of the island should be purchased and made into an Experimental Station. The reasons set forth in the letter are very forcible, and it would certainly be a good opportunity for testing and showing the value of better methods of manufacture. The remark is frequently made by planters from Demerara that we know how to grow the canes but not how to reap them. This would seem quite true when we hear of the improvements in their machinery, both in crushing and evaporating. But another fact might also be demonstrated at the new station, and that is the loss which occurs at every point unless a very careful watch is kept. As the large factories, such as Calumet and Caffrery in Louisiana, the raw juice is tested, both before and after sulphuring, to decide whether inversion is being caused by sulphuric acid being formed instead of sulphurous acid gas—the latter being the bleaching agent and useful for giving a certain colour to the crystals—the former converting sugar into molasses. The loss under this head must be very great in Barbadian sugar houses where sulphur is used, as the vapour pipes of evaporators are never tested to see if any sugar is passing away in the steam. After the mud has been pressed quite dry it is found to contain from 8 to 10 per cent. of sugar, this is washed with water and the sweets extracted.

"All the canes, too, are weighed, and the juice polarized, and when the results in sugar are not as they should be, the loss is discovered and checked. When it is remembered how much cane juice has been thrown on our cattle pens in past years, before filter and mud presses were used, it should make us anxious to find out where next we can check waste. If it is found worth while in other countries to find

out and stop the loss even in the dry mud, there is just as much need to do it here, and until we do our best to save the large quantity of sugar lost by bad crushing (over 1800lb. per acre in an average return with average crushing, as proved at Dodds from a five year examination) and in other departments of our complex yet uncomplete system of reaping (and growing, too, perhaps) it is not fair to grumble at low prices caused by competition with inferior raw productions, which can successfully compete with us *because they lose nothing which they can possibly save and are always careful to see that there is no preventible loss.*

"But even after we have manufactured our cane juice, as we do, we are not careful to preserve what we have, as remarked by a foreigner lately, 'I can't understand how you planters can make out you are so badly paid for your crops when I see all over the island, and in the railway trucks, such a waste of molasses out of the puncheons, and sometimes, too, of the sugars out of the hogshead; and then I am told that the planter delivers his molasses in that freely-emptying state, and is satisfied for the merchant to hold it for 24 hours or more before it is determined how many gallons of molasses the puncheon contains. Such a state of things you would not see in the States with a crop of any kind.' And is not the above quite true? Is it not a well-known fact that after the molasses is dropped from the trucks that a small crowd gathers around and collects the outpouring molasses froth, and that the puncheons, containing what ought to be to the poor planter very precious fluid, after being in *the sun* for many hours are rolled into the stancheon and the bungs driven out, the molasses often spouting up 2 feet high and continuing to pour out for many hours. After this the puncheons are gauged. Is it any wonder that 12 @ 20 gallons are often found to be out of the puncheon, and is this not a preventible waste? The difference of a cent or two for cutting canes will be allowed to keep back a crop and breed general disaffection in an estate, and 8s. to 10s. is lost out of a puncheon of molasses with not an effort to hinder it.

"Committees have been, on more than one occasion, appointed by the General Agricultural Society to enquire into and report on the feasibility of having our molasses weighed instead of gauged, but owing, I am told, to the fact that merchants have expressed themselves unfavourable to the proposed change the matter has been dropped. But surely the planter body ought not to acquiesce in allowing this, to them, important matter to be quietly shelved when perhaps energetic and combined action on their part might be productive of some improvement in the present unsatisfactory state of things. But even without this change the waste of molasses can be stopped by some persons."

GERMAN OPINION ON THE PROGRESS OF THE CANE SUGAR INDUSTRY.

At the General Meeting of the German Beet Sugar Manufacturers' Union, held at Cologne in May, Herr Privy Councillor Kieschke delivered himself of the following opinions with regard to the capability of development of the cane sugar industry in general. He said he had always been of opinion, contrary to the general view, that the beet had no cause to fear the cane, and this opinion had been verified. On the average the cane contained no more sugar than beets grown in favourable districts. But in the same way as the beet had been in the course of time improved, people had now got so far with the cane that they were not content with what comes to their hand by natural growth, but are proceeding to grow selected and choice sorts, and to find out what was the kind best adapted to a given soil. In the Botanical Gardens at Barbados 60 different sorts of sugar cane had been planted by way of trial. Formerly it was urged that the cane sugar producers had not at their disposal the capital necessary for developing the industry. But experience had shown, that as soon as prospects improved, there was plenty of capital at hand. The treaties of commerce by which Cuba and Brazil are securing a safe outlet for their sugar in North America, secured for the sugar industry of these countries the capital for its increase and improvement. At one time people made a point of the want of labour in the Colonies. Now this was being dealt with by importation of Chinese, who are much esteemed as cheap labourers. Formerly it was the custom to talk of a permanent inferiority of the cane sugar producing countries, and to say that if progress were made there, then we should have to make further and greater progress. Nothing was more incorrect than this opinion. We (in Europe) were their teachers, and they our scholars, who had to pay nothing for being taught. The results which the years had brought us, they could adopt and make their own in a few weeks, without being compelled to pass through all the experiments, sacrifices, and failures which had led to European success. The best proof of this was to be found in diffusion, which was now being successfully introduced in all the cane producing countries. The difficulty caused by the necessity of first drying the bagasse before it could be used as fuel, had now been got over by special contrivances for heating. These countries had also the advantage of being much better able than the German farmer to produce something else in place of sugar, if a bad time for the cane industry should supervene, whilst the North German agriculturist was compelled in all his arrangements to stick to the beet.

THE COST OF MANUFACTURING CANE SUGAR IN LOUISIANA.

The *Louisiana Planter*, replying to some questions put by a subscriber, makes the following very definite statements on the above topic, which seems to bear out the complaints that were made, shortly after the proposal of the McKinley Tariff Bill, that the planting and production of sugar would after all be no very "fat thing":—

"The next question propounded by our correspondent is quite difficult to answer, owing to the varying capacity of the various sugar houses, the manual and skilled labour therein, and to the excellence of the work done.

"The true current expenses of the sugar house or factory begin with the cane dumped in the cane yard, or delivered there in cars, and only end when the finished sugar is rolled out on the wharf in barrels ready for shipment. These are the current expenses which generally determine the cost of manufacture per ton of cane consumed.

"The matter of taxes, insurance, interest on the capital invested, depreciation of the plant, annual repairs, and a proportion of the salary of the general manager, constitutes a positive and large additional cost to be charged to the tons of cane handled, and it will amount to as much as the current expenses in every economically conducted sugar house.

"The general cost of manufacturing sugar cane into sugar rarely falls below $1·50 per ton, even under the most favourable conditions. Where careful chemical control is exercised and the whole work is done in the best known manner, the cost will reach $2 or more per ton of cane, while it is of course expected that the better results will far more than cover the increased cost.

"In order to determine the costs of manufacture other than the *current expenses* herein alluded to, and which we may call the *fixed* charges or expenses, let us consider a sugar house capable of grinding 15,000 tons of cane during a season of sixty working days, say 70 to 80 calendar days. A low estimate of the value of such a sugar house would be $50,000, and the *fixed charges* would be composed of the following items:

	Dols.
Taxes, $50,000 at 26 mills	1,300
Insurance, at 1½ per cent.	750
Interest, at 8 per cent. on value	4,000
Depreciation, 1·10 annually	5,000
Annual repairs	3,000
Half salary General Manager	2,500
	$16,550

"These charges will be seen to be reasonable. There is no charge whatever for improvements, and such as are made must be made out of the allowance for *depreciation*, where no improvements are made. A sugar house that stands still to-day will have no more value in a few years than attaches to the old iron, copper and brass that may be saleable.

"These expenses herein named are then all matters of actual cost, and they amount to $1·10 per ton of cane consumed in the sugar house. We have assumed to grind 15,000 tons per season. Add to this $1·50 per ton for *current expenses*, and we shall have $2·65 as the inside cost of converting a ton of cane into its completed produce, and where extra fine work is done the cost will range between $3 and $4.

"If we assume the price of clarified sugars, plus the bounty, to be five cents, and of string sugars four cents, then the moderately good sugar house, producing 160 pounds of sugar per ton of cane, will realise:

120 pounds first sugar at 5c.	$6·00
40 ,, second sugar at 4c.	1·60
Total	$6·60

COST.

Per ton of cane purchased, basis	$4·00
Current expenses of manufacture	1·50
Fixed charges	1·15
Total	$6·65

"This sugar house must increase its yield or cheapen its cost of working, or make no money. Molasses is so nearly valueless that we omit its consideration. The sugar house, that by its better methods can average 200 pounds of sugar per ton of cane, would realise:

150 pounds first sugar at 5c.	$7·50
50 pounds second sugars at 4c.	2·00
Total	$9·50
Cost per ton of cane, purchased basis	$4·00
Current expenses of manufacture	2·50
Fixed charges	1·15
Total	$7·65

"Such a sugar house could make money on the basis of $4 for cane and five cents for sugar, and a yield of 200 pounds per ton, but there are very few such sugar houses in Louisiana, and the fixed charges on them would be higher than our estimate.

"While these figures show how close is the sugar business, still there is money in it if the work done be of a higher order and done with reasonable economy. The high grade sugar houses must get over 200 pounds of sugar from a ton of cane and the average good house must get over 160 pounds, else they cannot pay $4 per ton for cane on five-cent sugar."

UNITED STATES.

Imports and Exports of Sugar.

At this time, when the making of treaties is receiving so much attention, and reciprocity is being carried into actual practice, it will interest our readers to see some plain facts representing sugar put in a concise and readable form.

Importations into the United States will average at the present time not far from 2,887,000,000 pounds annually, valued at $72,450,000. As the value of all classes of imported goods is about $430,000,000, it will be seen that sugar represents about one-sixth of all goods or articles imported. The sugar imported from the Sandwich Islands is not included in the above, and as sugar from that source is over 275,000,000 pounds, the total value of all sugar imported will reach nearly $82,000,000. The sugar we import comes mainly from the so-called Spanish-American countries, Cuba sending us about one-half, and Brazil and the British West Indies each about one-eighth, Brazil being a little the largest, sending us something over 325,000,000 pounds, British Guiana, San Domingo, and Porto Rico, supplying most of the remainder. Mexico in 1888 sent us 614,574 pounds.

The importation of beet sugar from Europe is growing into goodly proportions, and in the year ending June, 1888, amounted to about 65,000,000 pounds. The following year, viz., ending June, 1889—the quantity had nearly quadrupled, and reached the large amount of 243,474,000 pounds. The use of this grade of sugar will before long have such a strong hold upon the people that the growers of cane sugar will have to recognise this competition.

The Spanish-American countries are large importers of refined sugar, and as they would naturally favour buying cane sugar refined rather than the beet sugar of Europe, which is grown in direct competition with their product, we can hope to see our exportations of refined sugar increase as soon as the means of communition are improved, as they undoubtedly will be before many months. Our exports of refined sugar at the present time amount to about 12,000,000 pounds to Spanish-American countries, and 36,000,000 pounds to all the world, valued at $2,300,000, besides 7,230,000 gallons of molasses.

In the examination of statistics on subjects like that of sugar one is apt to find many curious facts. In this connection there is nothing more peculiar than the fact that most of the countries growing cane sugar are large importers of beet sugar, and this can only be accounted for in two ways—the bounty paid by European countries to growers of beet sugar, and the superior means of transportation between Europe and Spanish-American countries, enabling the refiners of beet sugar to undersell their competitors.

Another peculiarity is, that Cuba, in the year 1888, imported from the United States less than a ton of refined sugar, the value of the importation being $100, and during the same time was a customer for $17,000 worth of candles (American). The United States of Columbia was our largest consumer for refined sugar, the quantity being 3,200,000 pounds, or about three pounds for every four pounds of raw sugar sent by that country to the United States.

The sugar grown in the Southern States amounts to nearly 400,000,000 pounds annually, and in order to find the total production of the United States, we must add the average production of maple (20,000 tons), beet (1,600 tons), and sorghum (360 tons), making a total of something over six pounds per capita of domestic sugar out of a total of fifty-two pounds per capita consumed, showing that we used forty-six pounds of foreign sugar for each six pounds grown in the United States.—Letter to the *American Economist.*

PORTO RICO.

The following details have been sent us by a correspondent.

With respect to the crop which is now drawing to an end in Porto Rico generally, I can unfortunately give a very poor report. It is certain that on account of the hopeless drought, not one single factory has produced more than in the preceding year, and one may count on the fingers those which will close the season without a loss, whilst the name of those which will not make their working expenses is legion. On our small island (Vieques), especially, we have had as good as no rain for 15 months, the general state of things was verging on a famine, when at last, about 14 days ago, the rains of this year set in, although only in very moderate showers. Of course they came too late for the crop, but they will be of advantage as permitting the fields to be cleared quickly, and the new plantings to be brought to an end, so that we may indulge new hopes in regard to the coming crop, in place of the continued depression of feeling which has hitherto prevailed.

The following laboratory details will indicate pretty clearly the poor state of the present crop :—

Cane Delivered at the Mill.

Plant Canes.	*Ratoon Canes.*
Length :—13½ to 23 inches.	Length : —33 to 44 inches.
Diameter :—½ inch.	Diameter :—¾ to 1 inch.
Knots per metre :—60 to 80.	Knots per metre : —30 to 40.
Analysis of Plant Canes.	*Analysis of Ratoon Canes.*
Specific gravity :—1·05.	Specific gravity :—1·06.
Quotient of purity :—75.	Quotient of purity :—80.

The percentage of juice varied between 82 and 86.

The acidity and the amount of invert sugar much higher than in the preceding year.

The average figures for the past year were :—

Length :—66 to 100 inches.

Diameter :—1⅜ to 1⅝ inch.

Knots per metre :—4 to 10.

Percentage of juice :—Nearly 88.

Specific gravity :—1·08 at 77° F.

Quotient of purity :—85½ ; invert sugar 1·1, and acidity 2 per cent.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; 63, Long Row, Nottingham; and 323, High Holborn, London.

ENGLISH.

APPLICATIONS.

8440. Edmund Edwards, London. (Communicated by Otto Arlt, Germany.) *Improvements in filtering materials and filters.* (Complete specification.) 16th May, 1891.

8545. John C. Mewburn, London. (Communicated by the Maschinenfabrik, Grevenbroich, Germany.) *Improvements in the crystallisation of saccharine and other solutions.* 19th May, 1891.

8546. John C. Mewburn, London. (Communicated by the Maschinenfabrik, Grevenbroich, Germany.) *Improvements in the treatment of solutions which have been boiled in the granular state.* 19th May, 1891.

8809. William J. Mirrlees, London. (Communicated by Homer T. Yaryan, United States.) *Improvements in evaporating and distilling apparatus.* 23rd May, 1891.

9910. Alfred Julius Boult, London. (Communicated by Lionel Louis Josse Antoine Wackernie, France.) *Improvements in filtering apparatus.* 27th May, 1891.

9168. Emanuel Pechnik and Sigmund Stein. *Improvements in the manufacture of sugar.* 1st June, 1891.

9244. Samuel E. Ball, Liverpool. *Improvements in candy moulds.* (Date applied for under Patents Act, 1883, Sec. 103, 31st December, 1890, being date of application in United States.) Complete specification. 1st June, 1891.

9665. Ernest Ruescher, London. *A process for separating impure sugar masses in one operation into crystallised sugar and molasses, avoiding all after products.* (Complete specification.) 8th June, 1891.

9711. Henry Harris Lake, London. (Communicated by William Emery Nickerson, United States.) *Improvements in vacuum pumps.* 8th June, 1891. (Complete specification.)

9712. Henry Harris Lake, London. (Communicated by William Emery Nickerson, United States.) *Improvements in rotary vacuum pumps.* 8th June, 1891. (Complete specification.)

9713. HENRY HARRIS LAKE, London. (Communicated by Adolph Berrenberg and William Emery Nickerson, United States.) *Improvements in and relating to vacuum pumps.* 8th June, 1891. (Complete specification.)

ABRIDGMENTS.

8790. WILLIAM R. WATSON and ROBERT A. ROBERTSON, both of the firm of the Mirrlees, Watson, and Yaryan Co., Limited, of 45, Scotland Street, Glasgow, N.B., Engineers. *Improvements in apparatus for evaporating, concentrating, and distilling liquids.* June 7th, 1890. This invention comprises improvements on a former patent, No. 11,485, 1888, and has for its object to simplify the construction of the apparatus and to render it more easily packed for transport. A triple-effect is shown in the drawings. The liquid, after passing through the vaporizing tubes in the vessel or vessels forming the apparatus, passes into a separating chamber which is attached directly to the lower part of the casing enclosing the front ends of the vaporizing tubes. According to the present improvements, the separating chambers are formed into a column, and this construction realises the above advantages.

10461. JESSE SELLARS, 30, Dairy House Road, Litchurch, Derby, pattern maker. *Improvements in centrifugal machines.* July 7th, 1890. This relates to continuous centrifugals. The outer basket is formed of a series of vanes which normally lie at right angles to the radii of the basket, but which are caused automatically to feather at a certain point in the revolution, and so allow the filtered mass to discharge.

AMERICAN.

ABRIDGMENTS.

444945. EDWARD THEISEN, of Cologne, Germany. *Evaporating and cooling apparatus.* January 20th, 1891. The liquid is sprayed or dashed by means of revolving horizontal discs. The hot air or other heating medium is fed towards the centre of the discs, thus securing more complete interchange of heat.

447258. JOHN PATTEN, of New York, assignor to the John Patten Manufacturing Co., New York. *Method of and apparatus for separators from foaming concentrated solutions.* February 24th, 1891. A number of circular perforated plates revolve vertically in a cylindrical vessel, and the vapours from the boiling solutions are caused to pass through the perforation. The lower portion of each plate dips in and is covered by liquid which washes off accumulation of salt, &c.

445266. G. W. Rogers, of Lisbon, Louisiana, U.S.A. *Evaporator or syrup pan.* January 27th, 1891. The transverse partitions of the pan decrease in height one by one towards the entrance. The scum thus tends to flow towards the thin syrup, from which it may readily be removed.

447313. J. H. Grimm and W. G. Pennypacker, of Wilmington, Delaware, U.S.A. *Apparatus for reburning animal charcoal.* March 3rd, 1891. A series of tubular retorts supplied with worm conveyors and communicating with each other in regular sequence is heated by superheated steam. The stated advantages are ability to control the temperature and even treatment of all the "char."

448776. Thomas Gaunt, of Brooklyn, N.Y., U.S.A. *Evaporating apparatus.* February 3, 1891. This is an "in transit" apparatus, the heating and supply tubes of which are loosely attached to the outer casing to allow of expansion, &c., from changes of temperature. Proper packing is applied.

447673. Friedrich H. Flottmann, of Bochum, Germany *Vacuum pan.* March 3, 1891. This apparatus seems applicable for use in the extraction of juice from beet, &c. It comprises an internal and an external vessel, the former of which is capable of revolution within the latter, the space between them being provided with suitable connections for the supply or circulation of steam, hot air, or other medium. The outer vessel is mounted on hollow trunnions, and provided with mechanism for bringing it into the working position or filling and emptying position.

447816. Thomas Gaunt, of Brooklyn, New York. *Multiple effect evaporating apparatus.* March 10th, 1891. An improved "in transit" apparatus to secure cheapness and simplicity. It consists of an outer case divided into effects by vertical partitions, each division containing a series of horizontal evaporating pipes and a vacuum maintaining device, which causes the vapour arising from off one series to pass through and heat the next. The liquid is fed independently on to each series of pipes, being evaporated and concentrated by dropping from pipe to pipe.

447817. Thomas Gaunt, of Brooklyn, New York, U.S.A. *Evaporating apparatus.* March 10th, 1891. The invention consists of an evaporator, preferably of the "in transit" type, in combination with a liquor supply, such as a tank or reservoir, and an auxiliary chamber placed between the two. The liquid is circulated through the

evaporator and auxiliary chamber by a suitable pump, and additions of weak liquor from the tank are automatically made by means of a counter-balanced supply valve. The liquor may thus be concentrated to any desired or predetermined specific gravity.

449327. HUGH W. LAFFERTY, of Wilmington, Delaware, U.S.A. *Centrifugal machine.* March 31st, 1891. Improvements on a former invention (Patent 422083) which provided a double basket, the outer and inner pieces of which revolved independently. The present improvements comprise simple means for varying the ratio between the speeds of the two, one belt only being employed.

449747. GEORGE E. PATRICK, of Ames, I., U.S.A. *Apparatus for extracting from saccharine materials.* April 7th, 1891. By diffusion. The liquor is heated on its way from cell to cell by passing through intermediate troughs. A heating cell is provided for giving a preliminary treatment to the cane chips or other sugar bearing material.

449976. CARL STEFFEN, of Vienna, Austria-Hungary. *Apparatus for lixiviating sugar.* April 7th, 1891. This is an apparatus whereby the sugar may be subjected to the action of the various increments of lixiviating fluid of different degrees of purity systematically and in succession. Each lot of fluid is held in a separate cell or division of a chamber, and after passing through the sugar it is returned to the next in succession.

450209. WILLIAM W. WHIDDIT, of Newburg, New York. *Recarboniser for filters.* April 14, 1891. A perforated metallic plate, having on its under surface a number of projecting and perforated cones or tubes, is placed upon the bed of charcoal in a filter box, the upper plate of said box being first removed. When in position the ends of said tubes will sink slightly into the charcoal, and the whole is then reversed. The charcoal now falls loosely around the tubes and upon the plate, and heat from gas jets or hot air is applied to revivify the same.

GERMAN.

ABRIDGMENTS.

54815. H. JESSEN, Hamburg. *Improved machine applicable for cutting sugar bars.* 21st May, 1890. The cylinder, which effects the pushing forward of the sugar bar, is so connected with its gearing that its forward movement is for a time interrupted. During this stoppage the knife, raised by means of an eccentric, is, by reason of

its own weight and also by being specially weighted, drawn down, and the cutting off of the sugar stick is thus effected.

55171. P. BEUSTER, Görlitz. *Process for purifying raw sugar juices.* 2nd April, 1890. Soda carbonate, barium hydroxyd, and calcium hydroxyd are employed in succession in order that the organic non-saccharine matter may combine first with the soda and then with the baryta, and by reciprocal reaction bring the matter into such an insoluble form, that lime, even at boiling point, will not affect it. The process is specially useful in preventing precipitates of organic lime salts from separating out upon the heating coils of evaporating apparatus.

55157. B. WEISSER, Basle, Switzerland. *Apparatus for steaming and drying extracts, colouring solutions, and the like.* 30th April, 1890. This apparatus consists of a number of rotatable circular hollow vessels heated from within by means of hot water or warm air. These vessels are provided with scoops or shovels, which carry with them and distribute, over the different evaporating surfaces, the liquid to be evaporated. A pipe, which is in connection with the central shaft conveys the heating medium to the vessels.

55158. O. PIMIENTA, Cardenas, Cuba. *Process and apparatus for packing sugar and the like.* 6th May, 1890. The cubes are first drawn together upon a plate, by means of movable wedges, so as to form a layer. They are then brought upon this plate to a board placed in the slot of a table, upon which a movable plate rests in grooves. The first mentioned plate is then withdrawn from under the layer of cubes. In order to secure the latter against movement on the plate resting in grooves, a box, composed of sides so arranged that they can be of varying heights to suit the cubes, is raised from underneath the table by means of a screw-spindle, round the cubes. A second layer of cubes is then brought by the first mentioned plate, and laid on the top of the first layer, and so on until the desired height of cubes is reached. The sides of the box are raised so as to correspond with the height of every new layer of cubes brought by the plate. The packing case, intended for the reception of the cubes, is then placed from above over the box, which is lowered far enough to admit of this case with its contents being pushed upon the plate on to the table. The case is then turned over into its right position, the plate being meanwhile supported from underneath by the hand, and then closed with a lid.

55130. FR. RASSMUS, Magdeburg. *Improved knife-box applicable for cuttings.* 29th January, 1889. Two knives are so arranged in this knife-box that while the upper is screwed fast in the ordinary manner, the underneath one is fastened by means of cross pieces fixed in grooves in the front wall of the box.

54374. A. LEFRANC, L. LEFRANC, Tracy-le-val, Oise; A. VIVIEN, St. Quentin, France; and J. GÖRZ, Berlin. *Improvements in the purification of sugar solutions, molasses, &c., &c., by means of certain fluo-silicate combinations.* 31st December, 1889. For purifying liquids containing saccharine matter, fluo-silicate of lead, or fluo-silicate of iron in acid solution is used. Both combinations are said to aid in effecting the separation of the salts as well as the organic constituent parts of the beetroot juice. The process is also applicable to the juices of beetroot, cane, sorghum, maple, the purification of syrup, syrup water or molasses, as well as to the decolouring and purifying of refined sugar. For example, to one hectolitre beetroot juice, is added at least 3·6 litres of fluo-silicate of lead at 33 degrees Baumé, this is filtered after the lapse of an hour, the acid filtrate neutralised with milk of lime and again filtered, then a small quantity of phosphoric or sulphuric acid is added, sufficient to leave only a weak acid reaction. The liquid is again rendered alkaline by addition of lime, heated slightly and filtered over a mechanical or bone charcoal filter.

54549. FIRMA H. PUTSCH & CO., Hagen, Westphalia. *Improved knife-box applicable for shredding machines.* 30th March, 1890. In order to be able to place, according to requirement, the back row of knives opposite the front row, the knife seat is provided with two trunnions. One turn of the knife seat round the axis formed in this manner places the edge of the knives fixed upon it either higher or lower in the bed. Screws are used for fixing the knife seat in the required position.

IMPORTS AND EXPORTS (UNITED KINGDOM) OF RAW AND REFINED SUGARS.

JANUARY 1ST TO MAY 31ST.

Board of Trade Returns.

IMPORTS.

RAW SUGARS.	QUANTITIES.		VALUE.	
	1890.	1891.	1890.	1891.
	Cwts.	Cwts.	£	£
Germany	3,054,124	2,772,037	1,799,460	1,736,574
Holland..................	198,327	208,162	110,518	127,233
Belgium	439,396	492,129	232,146	291,654
France	777,246	766,846	478,725	512,943
British West Indies & Guiana	630,158	556,856	476,952	444,570
British East Indies	86,171	256,081	41,873	135,793
China and Hong Kong	....	....	....	....
Mauritius	36,802	72,786	24,394	47,333
Spanish West India Islands	....	19,935	....	15,699
Brazil	173,301	299,156	104,634	178,645
Java	557,165	983,130	425,955	685,471
Philippine Islands	46,569	359,804	23,269	196,621
Peru	297,045	199,714	200,074	139,917
Other Countries	137,567	242,090	97,090	171,520
Total of Raw Sugars ..	6,433,871	7,228,726	4,015,090	4,683,973
Molasses	207,643	197,962	69,975	63,707
Total Sugar and Molasses	....	....	7,443,152	8,486,725
REFINED SUGARS.				
Germany	2,127,564	2,591,444	1,728,493	2,109,548
Holland..................	732,803	614,813	609,923	520,873
Belgium	66,219	82,855	60,128	72,076
France	1,158,920	721,344	940,602	603,923
United States	21,328	501,150	18,384	423,079
Other Countries	718	11,616	557	9,546
Total of Refined	4,107,552	4,523,222	3,358,087	3,739,045

EXPORTS.—REFINED SUGARS.

	Cwts.	Cwts.	£	£
Sweden and Norway	25,621	33,364	18,372	25,536
Denmark	50,363	58,615	30,633	36,855
Holland	36,268	35,943	25,574	25,905
Belgium	11,675	9,498	7,963	6,533
France	4,099	170	2,651	126
Portugal, Azores, & Madeira	42,559	32,658	27,974	22,593
Italy	39,524	16,293	26,423	11,526
Other Countries	96,005	109,373	72,475	83,328
Total of Exports......	306,114	295,914	212,065	212,402

IMPORTS OF FOREIGN REFINED SUGAR.

The following figures give the imports of foreign refined sugar for the month of May, 1891, compared with the corresponding month of the two preceding years, and the average monthly imports for the year compared with those of 1888, 1889, and 1891, distinguishing the quantities of "Lumps and Loaves" from "other sorts," and showing the separate imports from each country:—

Countries from which Sugar has been imported.	"Lumps and Loaves."							"Other Sorts." Including Crushed Loaf, Granulated, Crystallized, &c.							Total.						
	Monthly Average.				May.	May.	May.	Monthly Average.				May.	May.	May.	Monthly Average.				May.	May.	May.
	1888	1889	1890	1891	1889	1890	1891	1888	1889	1890	1891	1889	1890	1891	1888	1889	1890	1891	1889	1890	1891
	Tons.	Tons.	Tons.	Tons.	Tons	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France.............	1686	1888	3428	1775	2263	3577	1911	4855	3398	8161	5438	6789	8808	3874	6541	5286	11589	7213	9052	12385	5785
Holland	3267	3005	3149	2901	2785	4081	2429	2675	3074	4179	3247	2710	4693	2689	5942	6079	7328	6148	5495	8774	5118
Germany & Austria ..	1510	2964	2849	2662	3352	3029	3154	11729	17245	18427	23252	19466	24146	24702	13239	20209	21276	25914	22818	27175	27856
Belgium	622	995	45	530	598	343	196	227	267	213	299	237	220	127	849	1262	662	829	835	563	323
United States	8	..	..	186	..	137	75	157	98	168	4825	24	737	3909	165	98	213	5011	24	874	3984
Russia.............	..	..	..	..	..	..	..	1959	4275	..	112	2002	..	..	1959	4275	..	112	2002	..	..
Other Countries	1	14	..	..	..	..	..	2	10	7	4	688	31	10	3	24	7	4	688	31	10
Total	7094	8866	9920	8054	8998	11167	7765	21604	28367	31155	37177	31916	38635	35311	28698	37233	41075	45231	40914	49802	43076

SUGAR STATISTICS—GREAT BRITAIN.

FOR THE FOUR PRINCIPAL PORTS.

To June 20th, 1890 and 1891.

In Thousands of Tons, to the nearest Thousand.

	STOCKS.		DELIVERIES.		IMPORTS.	
	1891.	1890.	1891.	1890.	1891.	1890.
London	35½	33	139½	130½	149½	114
Liverpool ..	46	64	140	135	132½	113½
Clyde	37	46	96½	109½	97	115½
Bristol	2	2	33½	34	32½	33
Total ..	120½	145	409½	409	411½	376

The above figures do not represent accurately, or to the full extent, the position and movements of sugar in the United Kingdom, as Hull, Leith, &c., are not included, there being no published returns for these ports.

SUGAR STATISTICS—UNITED STATES.

(From Willett & Gray's Report.)

For the four principal Ports. In Thousands of Tons, to the nearest Thousand. For May, 1891 and 1890.

	STOCKS. June 1st.		DELIVERIES. In May.		IMPORTS. In May.	
	1891.	1890.	1891.	1890.	1891.	1890.
New York	40	28	98½	72	112	87½
Boston	6	3½	20	16	23	18
Philadelphia....	7	1½	43	31½	47	32½
Baltimore	2	..	4	..	6	..
Total	55	33	165½	119½	188	138
Total for the year			679	554½	707	576

NEW YORK PRICES FOR SUGAR.

From Willett & Gray's Report, June 11th, 1891.

Fair Refining.	96o/o Centfs.	Granulated.	Stand. A.	Stock in Four Ports.
June 11, 1891.—2⅞c.*	3¼c.*	4 1-16c.	3 15-16c.	Jan. 1, 1891— 27,756 tons.
June 12, 1890.—5c.	5 9-16c.	6¾-13-16c.	6¼c.	Jan. 1, 1890— 11,169 tons.
June 13, 1889.—7c.	8c.	9⅛c.	8⅞c.	Jan. 1, 1889— 32,251 tons.
June 14, 1888.—4¾c.	5½c.	6¼c.	6¼c.	Jan. 1, 1888— 47,798 tons.
June 16, 1887.—4 7-16c.	5⅛c.	5⅞c.	5⅜c.	Jan. 1, 1887—102,279 tons.
June 17, 1886.—4¾c.	5⅜c.	6 3-16c.	5¾c.	Jan. 1, 1886— 57,328 tons.
June 18, 1885.—5⅜c.	6⅜c.	6⅞c.	6⅛-¼c.	Jan. 1, 1885— 89,186 tons.
June 12, 1884.—4⅞c.	5 11-16c.	6½-9-16c.	6⅛-¼c.	Jan. 1, 1884— 60,900 tons.
June 14, 1883.—6⅞c.	7 11-16c.	8 13-16c.	8 5-16c.	Jan. 1, 1883— 50,297 tons.
June 15, 1882.—7¼c.	8 1-16c.	9 7-16c.	8⅞c.	Jan. 1, 1882— 43,927 tons.

* Net Cash.

STOCKS OF SUGAR IN THE CHIEF MARKETS OF EUROPE ON THE 31ST MAY, 1891, FOR THREE YEARS, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal entrepôts	TOTAL 1891.	TOTAL 1890.	TOTAL 1889.
124	220	225	170	28	20	787	732	512

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING 31ST MAY, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal entrepôts	TOTAL 1890-91.	TOTAL 1889-90.	TOTAL 1888-89.
1371	538	486	309	63	387	3154	2930	2666

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE PRESENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1890-91. Tons.	1889-90. Tons.	1888-89. Tons.	1887-88. Tons.
German Empire..	1,335,000 ..	1,264,607 ..	990,604 ..	959,166
France	700,000 ..	753,078 ..	466,767 ..	392,824
Austria-Hungary.	760,000 ..	787,989 ..	523,242 ..	428,616
Russia	530,000 ..	456,711 ..	526,387 ..	441,342
Belgium........	200,000 ..	221,480 ..	145,804 ..	140,742
Holland........	65,000 ..	55,813 ..	46,040 ..	39,280
Other Countries..	80,000 ..	80,000 ..	87,000 ..	79,980
	3,670,000	3,619,678	2,785,844	2,481,950

The totals given by the *Deutsche Zuckerindustrie* and the *Prager Zuckermarkt* are respectively as follows:—3,554,500 and 3,557,000 tons.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

Since our last monthly report no very marked change has taken place in the position of cane sugars, and, considering the inactivity of the market, prices have been remarkably well maintained. Towards the end of the month there was more briskness, and quotations are only slightly lower than those given in our last, excepting for low East India and Philippine sorts, which are decidedly cheaper.

Refined sorts remain unchanged as concerns price, but with a hardening tendency. Foreign refined, quiet. Beet sugar, which became dearer just after our last report went to press, again went down slowly during the month until the last week, when an improvement took place, though prices are still 1½d. per cwt. under those of the last week in June.

It is difficult to account satisfactorily for the present state of things, excepting by a general feeling of indecision and resolution to buy only from hand to mouth. We adhere to the opinions expressed in our last, and think that the statistical position warrants the expectation of an upward move in prices.

Present quotations for the standard qualities, as under, are:—

Floating.			Last Month.
Porto Rico, fair to good Refining	13/- to 14/-	against	13/3 to 14/3
Cuba Centrifugals, 97°/ₒ polarization	14/9	,,	14/9
Cuba, fair to good Refining	13/3 to 13/6	,,	13/6 to 13/9
Java, No. 14 to 15 D.S.	15/- to 15/1½	,,	15/- to 15/1½
British West India, fair brown	12/6	,,	12/9
Bahia, low to middling brown	11/- to 11/6	,,	11/- to 11/6
,, Nos. 8 to 9	12/3 to 12/6	,,	12/6 to 13/-
Pernams, regular to superior Americanos..	11/3 to 13/-	,,	11/9 to 13/6
Landed.			
Madras Cane Jaggery..	9/9	,,	10/3
Manila Cebu and Ilo Ilo	9/3	,,	10/-
Paris Loaves, f.o.b...	17/-	,,	17/-
Russian Crystals, No. 3, c.i.f.	15/1½	,,	15/1½
Titlers	18/3	,,	18/3
Tate's Cubes..	20/-	,,	20/-
Beet, German and Austrian, 88%, f.o.b. ..	13/4½	,,	13/-

THE SUGAR CANE.

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All communications to be addressed and all cheques, &c., made payable to "Edward Sutton, Editor of The Sugar Cane, Manchester," which address is sufficient.

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☞ The Editor is not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

On pages 409 to 422 and 422 to 432 will be found two valuable contributions to the much vexed question of the comparative merits of diffusion and mill work. It is only by comparing statements of experience gained in actual working that any practical solution of questions such as these can be arrived at. In our position, removed from the actual theatre of operations, and unable personally to examine the details of working, and, we may add, but poorly competent to criticise profoundly all the various bearings of the statements of facts, suppositions, and estimates as to future probabilities, it would be presumptuous to express any definite opinion as to the ultimate general adoption, or the contrary, of the new system of diffusion. We may however be allowed to call attention to one fact, viz., that diffusion has, as our esteemed contributor, Mr. Stade, says, "now been practically in use on a large scale, for nearly 25 years,"—and to remark that during this period the anxious attention of first class engineers, chemists, and practical men has been constantly concentrated on its development and improvement to a most unusual extent. On the other hand it cannot be denied that an equal amount of concentrated and combined attention on the part of scientific, technical, and chemical experts has not yet been applied to the older form of extraction, so that we are driven to the conclusion, that while diffusion has, in Europe at any rate, been brought almost to the possible limit of perfection, it cannot be thought that we have heard anything like the last word as regards the possibilities of mill extraction. We shall therefore continue as at present, to afford our readers

every chance of comparing practical results, and express no other opinion than that already conveyed in our statement last month, viz., that we shall not be surprised if the ultimate result should be that each system, in virtue of its own special merits, is more adopted in a given part of the world than the other, the mill system of the most improved type holding its ground in certain quarters, and being replaced in others by more or less modified form of diffusion.

At a recent meeting of the Executive Committee of the Louisiana Scientific Agricultural Association, who have control of the Sugar Experiment Station at Audubon Park, it was determined to organise a sugar school, at which a two years' course in agriculture, mechanics and sugar chemistry will be taught by a competent corps of instructors. It will be known to our readers that a valuable school of the kind has been for some time in existence at Brunswick (Germany), and a similar institution is now being established in Belgium.

At the same meeting of the Louisiana Scientific Association the following resolution was unanimously adopted:—

"That recognising the valuable service rendered throughout the past five years by Dr. Wm. C. Stubbs at this station, and fully believing that it is has been the means of awakening throughout the State a spirit of progress in general agriculture, we tender that gentlemen a vote of thanks therefor, endorse his work, and determine to continue the work of the Station on about the present lines."

Readers of the *Sugar Cane* will know that this vote of thanks is most thoroughly deserved by Dr. Stubbs, whose indefatigable exertions have wonderfully aided the advance of the sugar industry in Louisiana and elsewhere.

Messrs. Willett and Gray give the consumption of sugar in the United States for six months ending 30th June, 1891, as 146,207 tons (=19½ per cent.) more than in the corresponding six months of 1890, the increase of 1890 over 1889 for the like period having only been 1·2 per cent. Consumption and export for the 1891 semester were respectively 894,258 and 28,871 tons, of which it is believed about 870,000 tons passed through the refineries, the remainder having gone into consumption in the raw state.

An injunction has been granted forbidding payment of dividend by the Brooklyn Sugar Refining Co., and the American Sugar Refining

Co., so that it would seem as though the legal position of the companies were not yet clearly made out.

The British Columbia Sugar Refining Co. at Vancouver is said to have seriously interfered with the American combination to keep up prices in California, and to have realised a very satisfactory profit from its operations.

Commercial treaties, similar to that negotiated with Brazil, are said to be on the point of signature between the United States and the sugar producing countries of Venezuela and Guatemala. Nothing certain has yet transpired relative to the negotiations between the United States and Germany, whereas France is taking steps to permit the import of American cured pork. France has a large surplus of sugar to dispose of, which can only find an outlet either in the States or in England.

The reported agreement between Claus Spreckels and the Sugar Trust appears to have been a *canard*, as we are now told that the former is about to double his producing capacity by erecting at Philadelphia nine new large buildings, enabling him to deliver 16,000 barrels of refined sugar daily.

A Trinidad correspondent of the *Deutsche Zuckerindustrie* lately wrote:—The two last years, 1888-1889 and 1890-91 (*sic*) were of a very critical character as regards our planters, and the particularly large deficit of the season just closed has led to a cessation of working on several estates. The death blow has been given by the Mc.Kinley Bill to the old-fashioned Muscovado manufacture, though people are unwilling to believe this. Every day the fact appears more plain, and it will not be long before one of the three following questions will have to be decided for life or death by those planters:—

1. Transformation of the factory into vacuum process.
2. Absorption of the estate by some large neighbouring plantation working with the vacuum process.
3. Giving up altogether.

If the planter has money, he can adopt alternative No. 1, and if he is free from debt, he can easily find an English firm that will supply the machinery and plant in exchange for a first mortgage on his property. If he is not so well situated as this, but his location enables him to try the second expedient, he can at any rate save something out of the fire. But unfortunately both cases are very

rare, and only No. 3 remains for him. Very often, as is the case with the firm I am with, and with the Colonial Company, Limited, the plantation is quietly allowed to lie fallow, as circumstances are not favourable enough for transforming the factory, and the continued manufacture of Muscovado sugar only incurs a further annual loss. The first loss is therefore the best.

At the seventy-third half-yearly meeting of the Colonial Sugar Refining Company, Limited, held in Sydney, when a dividend of 10 per cent. was declared, it was stated that the profits for the six months, after providing for interest and all other charges, amounted to £112,844. The out-turn of last season's crop of sugar had warranted the expectations mentioned in the last report, and the young canes now promised a fair yield in 1891 and 1892. In the following year it is hoped that a fourth mill in Fiji will be at work, the trial plantation on the Labasa River having shown that district to be suitable for cane growing, and the board having therefore decided to break up a large area of land at once and to arrange for the transfer of the necessary plant from Queensland. The competition in the sugar market had been more severe than usual during the past six months, in consequence of the pressure to sell the large Queensland crop; but the sales of the company's manufacture had been well maintained. Good progress had been made with the Adelaide refinery, and a possible extension of trade in the other colonies was being provided for.

The Agricultural and Industrial Association of Fiji reported at its general meeting as follows:—

Sugar.—This product has asserted for itself no mean position amongst the exports, notwithstanding the low prices still ruling. It is impossible however to say how long this export may continue. At present it would appear as not having emerged from the position of being maintained entirely at the expense of the future. The Colonial Sugar Refining Company have made arrangements for leasing a large area of native land at Labasa, on the Macuata coast, Vanualevu, for the purpose of starting a cane plantation. If the soil and climate prove equal to expectations, and there is no reason to doubt otherwise, operations on a large scale will be commenced by the Company during the present year in that district which must undoubtedly greatly increase this product. Exports for 1890 were 10,000 tons, against 13,178 tons in 1889.

The *Natal Mercury* has the following:—

"It is generally understood among well-informed circles in town that Messrs. Reynolds sugar estate of 11,800 acres at Umzinto, admitted to be the most successful in the colony, has been floated into a company in England with a share capital of £100,000 in 9,950 shares of £10, and 500 shares of £1 each, the energetic vendors retaining a large pecuniary interest in the company and remaining managers. We learn that the directorate is composed of many well-known Liverpool business men, whose names are sufficient guarantee for the soundness of the undertaking. Over 3,000 acres are in cultivation, with 3,000 acres of valuable wood attached. The land is black alluvial from three to five feet deep, under which coal is to be found, clay and stone are in abundance, and gold has been also seen. Umzinto Bay, five miles distant, will be connected by railway, and no dues will be charged on native or home goods shipped at this port. The property is valued at £97,605—land £23,000, crops £37,000, machinery £15,620, live and rolling stock £9,325. The profits of the business have shown a steady and constant improvement, the excess of revenue over expenditure for the year ending May, 1890, amounting to £18,871. On this basis, it is calculated the ordinary shareholders' profits will be at the rate of 25 per cent. per annum, but with the additional capital and improved working this will allow of, the profit should be greatly increased."

The abolition of the export duty on sugar, which seems to us an antiquated and mischievous mode of collecting revenue, is being mooted at Mauritius by the Chamber of Agriculture.

An article in the Berlin *Union* on Saccharine states that the saccharine lozenges now being prepared, of which there are 5,000 to the lb., one being equal to a lump of sugar for sweetening purposes, are being extensively used for long journeys and expeditions of various kinds. We are not yet satisfied that the medical experts are convinced of the harmless nature of this substance when regularly consumed for long periods. The trade journal in question has attained a certified circulation of 15,000 copies. It is published in English of a certain kind, such as *Kuhlow's* has made us familiar with as the "English as she is wrote" in Berlin, and which rejoices in the use of such words as "dulcification," "unproportionably," "innoxiousness," "fivehundredst," "domineerin " (apparently for "leading"),

"rigorous" (? for "strictly"), and a constant series of extraordinary, ludicrous, and impossible grammatical forms. Surely it would pay to employ a staff better acquainted with current and grammatical English, and so avoid the hopelessly ridiculously jargon of which even hundreds of specimens could be gleaned from a single number of either of the two journals named, not to mention the risk accompanying the use of incorrect terms in scientific and technical matters. We are not yet prepared to adopt a *lingua Teutonica* as the medium of our international communications.

We are informed that the "Compagnie Fives Lille" of Paris has become convinced (by the experiments made in that city) of the utility and complete success of the Chapman Patent Circulator, and has made arrangements with Messrs. Fawcett, Preston & Co., Limited, of Liverpool, for the exclusive right of manufacturing this apparatus for France and her colonies, working also in conjunction with the proprietors in other parts of the world than England and her colonies.

The American *Grocery Trade Press List*, first published about six months ago in Jersey city, seems to be filling a useful place, and attaining a good position as a reference for all engaged in the trade in America, Great Britain, and the colonies. Such publications are a necessity now that all trades tend to become more or less international.

UNITED STATES.

Proposed New Sugar Refinery in Louisiana.

It appears that the New York and Philadelphia refiners are not going to have all the benefit which is to be got out of the rearrangements of the New Sugar Tariff Bill. The following circular has been issued to planters and sugar manufacturers in the Southern States, and the names at the bottom vouch for the certainty of good and intelligent management, if sufficient support should be met with. The letter about the effect of the McKinley Bill (addressed to the *Sugar Bowl*), which we insert next after this circular, indicates considerable probability that the matter will be seriously taken up by the Southern planters and others interested:—

New Orleans, La., April 8th, 1891.

Gentlemen, — The future prosperity of the sugar industry in Louisiana will without question, depend not only on the adoption of econonomical measures for the production of raw sugar, but also on

the combined, energetic and determined effort on the part of all parties interested to influence and guide future legislation, and to prevent the forming of any combination that would affect the sugar market to our loss, as also to provide means by which our raw sugar will find a steady and permanent market at a price based on what the consumer actually pays, less a small percentage for the cost of refining. To this end it is proposed to erect in the city of New Orleans a large refinery, to be known as

THE LOUISIANA PLANTERS' SUGAR REFINERY COMPANY.

Three-fourths of the stock of this refinery is to be owned by parties directly interested in Louisiana sugar, as the whole management of the refinery must be with a view to assist the sugar interests of the State. The object of the refinery is to produce competition, which is actually necessary to the success of sugar in Louisiana. This fact was practically illustrated last year in the New Orleans market. Had Harrison, Frazier & Co., and Claus Spreckles, not been in competition with the sugar trust our sugar would have sold for less than it did.

There is every reason why this competition should be in the hands of Louisiana sugar men, and if a combined and determined effort is made there is no question of the issue, as we can by unison of action, guide and influence legislation and maintain competition; and with these two factors in our hands, the sugar interests of Louisiana must prosper.

This circular letter has been addressed to all parties interested in sugar in Louisiana and Texas, in order to ascertain whether or not the proposed refinery scheme would be favourably considered; and we would be pleased if you would advise us as to your views, and if you would assist the enterprise. A prompt reply will be appreciated, in order that immediate steps can be taken to formulate plans of action.

Please address all communications to L. W. Brown, Morris Building, New Orleans, La.

Yours respectfully,

H. C. WARMOTH,
J. B. LEVERT,
LEON GODCHAUX,
F. M. AMES,
A. L. MONOT,
H. C. FORSYTH,
JULES BURGUIRES,
LEMANN BROS.,
JOHN FOOS,
JOHN N. PHARR,
SHATTUCK & HOFFMAN.

BEAUTIES OF THE FREE SUGAR SCHEME.

(Letter to the *Sugar Bowl and Farm Journal.*)

Whatever of beauty may be discovered in the McKinley tariff, or whatever of profit it may be to any class of American consumers, one of its worst features is the abolition of the duty on all imported sugars not above 16 D. S. in colour, meaning thereby all imported sugars, as the quantity of sugars above 16 in colour are insignificant, and are not likely to be increased by any provision in the McKinley tariff.

In the year ended June 30th, 1890, only 427,748 pounds of sugars above number 13 D. S. in colour were imported for consumption; under the free sugar tariff refiners can import the highest grades of dry centrifugal sugars, coloured in making, not to exceed number 16 in colour, free of duty, and mixing such high grades with a moiety of lower grade sugars can refine and out-turn sugars for consumption which defy foreign competition and render the specious pretence of the McKinley Bill subject to censure and ridicule, and open to the graver charge of being a public imposition.

The expectations of consumers that the abolition of duty on sugar would result purely to their advantage without any drawback, are being rapidly disappointed; not only are wholesale prices of sugar being gradually increased through trade combinations, but the rapid depletion of the Government Treasury clearly indicates that the loss ol revenue from sugar must be made up either by the restoration of the duty on sugar, or by direct taxation, or by other desperate means to which Congress will be reduced in order to meet deficiencies and provide for public expenditures and rapidly maturing obligations.

Glancing at the annual consumption of sugar imported, the following summary gives a general insight of the magnitude of the sugar trade and the dependence of this country upon foreign producers for this article of food of necessity as well as luxury in preparing sweets and other delicacies used by the people who have become the greatest consumers of sugar in the world, and whose educated tastes demand the highest grades of refined sugar that can be made as a rule.

In the year ended June 30th, 1890, the importation of dutiable sugar for immediate consumption was 2,607,113,114 pounds, and of free sugar under the Hawaiian treaty 224,457,011 pounds, or a total of

2,831,570,125 pounds, the foreign cost of which was for dutiable sugar $82,743,777, and for free sugar $11,549,828, a total cost of $94,293,605, the duty collected on sugar in the same year was $53,985,874; of this vast amount only 427,748 pounds were above No. 13 D. S. in colour, this being the quantity that the famous McKinley tariff now levies duties on so pretentiously, deducting the same from the total imports there remains 2,606,685,666 pounds imported, upon which $53,974,475 duty was collected, or 2·07 cents per pound, the average foreign cost of dutiable sugar in the year named was 3·2 cents per pound, and of Hawaii free sugar 5·1 cents per pound.

Advocates of abolition of the sugar duty tell the people that sugar is now cheapened to consumers 2·07 cents per pound, but hard facts tell us that they lie. Of the duty collected as stated above, $12,000,000 will be required to pay bounty to sugar producers in this country the first year, and at least $1,000,000 will be expended in executing the bounty law, thus wiping out nearly one-fourth of the pretended saving to customers. The foreign cost will also be enhanced because higher grade sugar will be made for this market, and consequently there will be a loss of refining industry in this country in like proportion, to which must be added the entire loss of the American industry of molasses boiling for the sugar contents.

The McKinley tariff offers a bounty to foreign producers of sugar who are invited to make higher grades of sugar for this market which the McKinley tariff will admit free of duty, yet all such sugars must be again refined in this country before they reach consumers. Louisiana and all sugar producing States must not only compete with these disadvantages, but stand in constant dread of the repeal of a bounty law that is obnoxious to the people of this country.

Assuming that American refiners continue to use the same proportion of low grade raw sugar for refining purposes that were used prior to the taking effect of the McKinley tariff, granulated sugar should now be sold at refineries for 3 1·2 cents per pound, and to consumers at not above 4 cents per pound; this would leave a margin of half a cent per pound for division among jobbers and retail dealers, or a gross profit on consumption of $14,157,885. The fact is that refiners are getting about 4 3·8 cents per pound for fine granulated, and consumers who indulge in cut loaf sugar are getting sweetened.

The 2·07 cents per pound of duty abolished is in the second month of "free sugar"; already largely absorbed by enhanced first cost

and by refiners and jobbers, then comes bounty to pay and revenue deficit to provide for, all of which must be added to the present price to consumers to determine exactly what sugar now actually costs the American consumer. Plans are also on foot to divide the balance of duty saved, among refiners and middlemen, while Havemayer and Spreckels quarrel in public, and combine over their wine to raise prices, not for their own profit at all, but for the especial benefit of consumers. Item, "Claus Spreckels and son were in town yesterday and visited the American Sugar Refinery Company's office," doubtless to reduce the cost of refined sugar to consumers.

HENRY A. BROWN.

INDIA.

SUGAR CULTIVATION.

Under the above heading we referred, in October, 1890, to a letter addressed by Mr. Francis Gill, manager of the Nellikappam Sugar Factory, to the Madras Government, and the somewhat unsatisfactory reply which he had received, It appears that some attention is being given to the question of improved sugar cultivation by the Indian Government, as the latter has communicated to Mr. Gill some remarks made by Mr. A. C. Sen, of Cuttack. This is at any rate satisfactory as far as it goes, and we have pleasure in quoting, from the *Indian Agriculturist*, both Mr. Sen's remarks, which appear rather diffusive and not always to the point, and Mr. Gill's reply, addressed to the Collector of South Arcot. It is instructive to note that the latter dates back as far as February 15th, so that such matters are a long time in coming before the public, who are the most interested parties. Mr. Sen's note on Mr. Gill's letter on different varieties of sugar cane is as follows:—

"The chemical analysis of the juice of sugar-cane shows that it consists of a larger percentage of water, having a number of solid bodies dissolved in it. Among these solids are two varieties of sugar known to the chemist as (*a*) the sucrose, the cane or the crystallizable sugar, and (*b*) the glucose or the grape sugar. There is also a percentage, generally small, of mineral matters termed the ash. The rest consists of organic acids, gums, albuminous bodies, colouring matters and substances the composition and character of which are not yet known to the chemist.

"2. In the manufacture of *gur*, or concrete from the cane-juice, the whole of the solid matters dissolved in it is retained with the exception of a portion of the albuminous and other organic matters mentioned above, which coagulate on boiling and are thrown away as scum. The *gur* also retains from 8 to 12 per cent. of water. Generally speaking, therefore, the greater the amount of solids in a sample of juice, the more valuable is it for *gur*-making. It is however quite otherwise with its value as a producer of white sugar. White sugar is almost pure sucrose. The value of a sample of cane-juice as a producer of white sugar depends, therefore, not on the total amount of solid dissolved in it, but on that of sucrose. But even the absolute amount of the sucrose in the juice is not the true measure of this value. It has been found that by the methods *generally practised* by the sugar-cane refiners, the whole of the sucrose present in the juice cannot be obtained as white sugar. The presence of glucose, and specially that of ash, very much interferes with the process of sugar-refining. It is generally understood that for every part of glucose present in the juice, an equal weight of sucrose, and for every part of ash five times its weight of sucrose are rendered unrecoverable and are retained in the treacle. The relation between the amount of sucrose that may be obtained as white sugar from any sample of cane-juice and the composition of the latter may be expressed mathematically by the following formula :—

As=Is—(Gs plus 5 Ash)

Where As=available sugar, or the amount of sucrose that may be obtained as white sugar.

Is=the total amount of sucrose in the juice.

Gs=the amount of glucose.

Ash=the amount of ash.

"3. It is, therefore, quite possible that a sample of cane-juice that may be made into *gur*, though not of good quality, yet quite marketable, may be perfectly valueless as a producer of white sugar. This is the case with Mr. Gill's first sample of cane-juice. The soluble solids in it have the following percentage composition :—

Sucrose	49·89
Glucose	39·01
Ash	3·95
Other substances	7·15
Total ..	100·00

From our formula for calculating the amount of available sugar, we find:—

$$As=49{\cdot}89-(39{\cdot}01 \text{ plus } 5x\ 3{\cdot}95)$$

which shows that not a grain of white sugar can be obtained by the *ordinary* methods from such a sample of cane-juice.

"4. White sugar, we know, is obtained in two different ways, first, directly from the cane-juice by the method known as the *modern method;* and secondly, from the *gur* by the method known as *sugar refining.* The formula given above may also be used in calculating the amount of white sugar obtainable from a sample of *gur*, and like a sample of cane-juice, a sample of *gur* may also be quite valueless as a producer of white sugar.

"5. Having now learned that the value of a sample of juice or *gur* as a producer of white sugar is dependent on its composition, let us next inquire why does the composition of different samples of juice and *gur* differ? First, as regards the juice, results of analysis show that the juices of different varieties of cane differ in their composition; in other words, the composition of the juice is dependent on the variety of the cane. Mr. Gill terms it the *innate difference.* But Mr. Gill has, I fear, exaggerated the difference in the composition of different varieties of cane as regards the amount of glucose. That different varieties of canes differ in their composition, and that the amount of glucose in them is not the same, there is no doubt of, and the fact is not even unknown to the ordinary sugar-cane cultivators. But the difference in the amount of glucose in the same variety of cane when examined at different stages of its growth is much greater than that of different varieties examined at their maturity. This is evident from Mr. Gill's own figures, for there can be no doubt that his sample No. 1 was immature cane. Why there should be an excess of glucose in the immature cane is not difficult to explain, if we take into consideration the formation of sugar in all sugar-producing plants. Sugar is not produced in the plant all at once. The first visible product is starch, and this is formed in the leaves. Starch is an insoluble substance, and has to be rendered soluble before it could be carried to the remoter parts of the plant. Starch is for this purpose converted into glucose, and this substance by means of diffusion travels towards the lower end of the plant. If a cane be examined at this stage, no sucrose would be found in it. After reaching the last joint of the cane, glucose is converted into sucrose.

This substance being soluble diffuses upwards. This change goes on till the plant attaining maturity ceases to form starch. All the glucose is then converted into sucrose, excepting that in the few upper joints. If a cane be examined at this stage, it would be found richest in sucrose, and this is the proper time for harvesting the sugar-cane crop. If left to stand longer other sets of changes take place, differing according as the cane flowers and produces seeds, or dies without seeding, but all tending to reduce the amount of sucrose in the plant.

"6. But Mr. Gill has not stopped here. He has calculated what would be the money-value of an acre of land if planted with the different variations of canes he has analysed in his laboratory. More than this, he has attempted to show the loss the Bombay Presidency has been annually suffering on account of the raiyats there growing varieties of canes other than his ideal Salangore. In making this calculation he has made the first great mistake. In his calculation for all different varieties of canes he has assumed the same gross outturn of 20 tons per acre, whereas the real fact is that generally speaking the cane richest in available sugar is most deficient in the gross outturn. There seems to be a sort of compensating action among the different varieties of canes, tending to minimise the difference in their value as sugar-producers. One gives a heavy crop, but the quality of the juice is not good. Another is exceedingly rich in sugar, but the outturn is poor. A third gives a heavy crop of quality, but being exceedingly delicate, the crop cannot always be depended upon, and so on.

"7. But there are other conditions on which the composition of the juice is dependent, besides that of variety and the stage of growth. There are soils, manures, climate and diseases. The difference in the quality of the cane grown in the drier climate, and on the laterite sandy soil of Southern Shahabad, when compared with that grown on the recent alluvial soil, and in the damper atmosphere of Lower Bengal, is known to every one who has paid the least attention to the cultivation of the sugar-cane. The raiyats are well aware that dung, unless well rotten, if applied to a cane field, very much increases the amount of treacle in the *gur*. It is well known to the chemist that sucrose is easily converted into glucose by a variety of causes, among others by fermentation. There are certain diseases of the cane, especially those of the fungoid origin, that set

up fermentation in the cane while the plant is still living, and gradually convert the sucrose into glucose.

"8. Secondly, as regards the *gur*, its composition must necessarily be dependent on that of the juice, but it also depends on the treatment the juice receives in the preparation of the *gur*. Mr. Gill has, I think, very much under-estimated the effects of methods of manufacture on the quality of the *gur*. This is probably due to his want of knowledge of different localities. I would ask him to pay a visit to the cane-growing places of Chittagong and Tipperah, and I have no doubt he will be astonished to see how a black, dirty-looking mass, containing at least 5 per cent of charcoal, can be prepared from the best variety of cane under cultivation in India.

"9. The real fact is white sugar is the final product of a series of changes, some natural and some artificial, and to obtain it of the best quality, and at the cheapest rate, is the problem the practical man has to solve; we must attend to every one of these changes. Some of these changes may be of more importance than others, but not one of them can be neglected.

"10. Mr. Gill's suggestions, so far as they go, I have no fault to find with; but they do not go far enough. As regards the establishment of laboratories to examine sugar-cane as well as its preparation, for a long time to come we in Bengal would be perfectly satisfied if we could get only one well-equipped central laboratory of the nature suggested by him.

"(Signed,) A. C. Sen.

"Cuttack, 29th October, 1890."

"Letter from Mr. F. N. G. Gill, to the Collector of South Arcot, dated Nellikuppam, 15th February, 1891.

"With reference to the letter, No. 287, Miscellaneous, of the Board of Revenue (Revenue Settlement, Land Records and Agriculture, Madras), on the 19th January, 1891, addressed to R. B. Gill, copy of which I enclose, together with the note by Mr. Sen referred to therein, I have the following remarks to offer on Mr. Sen's note (on my original letter to the Government of India on sugar cultivation in India).

Mr. Sen has failed to grasp, if I may judge from his few remarks of tentative criticism of my letter, what was the unavoidable difficulty of my position in pursuing the line of argument adopted, viz., that

the inferiority of the raw sugars produced in India is mainly by reason of inferiority of the cane worked, owing either to, first, innate inferiority of the cane; second, unseasonable working of the cane, and comparatively little to crudeness of manufacture. Any figures taken by themselves I could bring forward of comparative analysis of canes would be liable to the objection that the differences observed might be observed in the same variety of cane, perhaps grown in the same field, or may be even in rattans cut from the same stool; but my position ostensibly does not rest simply on the analysis of the canes, but is founded equally on analysis of samples of large bulks of the jaggery, and in several instances on my practical experience of the working of this in the refinery, and the analysis and refinery experience. I have invariably found the variations accounted for by the quality of the cane yielding the jaggery in question. In truth, I should, as surmised by Mr. Sen, be astonished at meeting a jaggery, however black and dirty a mass, containing at least five per cent of charcoal, and I may add, it is impossible for me to discuss the possibility of such a thing as occurring in any bulk of jaggery.

Mr. Sen apparently represents the Department of Agriculture in India in the present discussion. May I be allowed to call attention to the amount of information on the subject possessed by the department as disclosed in the note under notice, and in Government of India Circular No. 163 70 C. Agri. Has the department no information to offer as to the varieties of cane grown in India, and as to seasons observed in their cultivation, and has it no suggestion to make for the remedying of its serious want of such knowledge?

I would in the absence of suggestions from the department offer the following extract from a letter by me addressed to the *Madras Mail*, 5th August last, for the consideration of the Government of India:—

* * * "I would strongly deprecate the raising of experimental crops in an early stage of the investigation at least. It would be amply sufficient for two or more seasons to collect through the depôts of observation which we will suppose established to command the whole of the cane growing districts in India, full information on the following points:—

"(1), Description of canes grown, (2), when planted and when ordinarily cut, (3), analysis of the canes from six months old to

thirteen months old, special arrangements being made with some rayat where necessary to keep an acre or so of cane on the ground, with suitable arrangements for the occasional watering required where the thirteen months exceed the time allowed by local custom or the exigences of water-supply for the crops to ripen, (4), how far there is actual coercion of the rayat to observe the seasons he does in the planting and reaping of his cane from the exigencies of water-supply, (5), general observation, on the method of plantings, of manuring, of keeping the fields of growing cane, and on soil, &c."

"With information on the above points we should be able to select canes with some certainty for a given district, and may be suggest modifications in seasons observed by the rayats and the irrigation authorities, with the assurance of largely improving the value of the cane crop. By and bye the Government might proceed to the raising of experimental crops from cuttings (and true seedlings perhaps) not only of canes already found in India, but also of canes not yet introduced. The subject of the improvement of the value of India's cane crop is a most important one, and I am sanguine that very much might be done for it by the Government in the manner suggested. I regard it as quite possible that such improvement would be made as to give to India industrial undertakings employing labour largely. It would also ensure the circulation of the value of white sugar consumed in the country, instead of its going out to but sugar-producing countries, as it otherwise must wholly and inevitably in a very few years; this too, when the white sugar consuming power of the people will have largely increased."

☞ The three concluding paragraphs of Mr. Gill's letter deserve special attention. The day must surely come when India will produce all the sugar required for what will then undoubtedly be her enormously increased consumption. It is only a question of time, and the more the questions above treated are agitated and discussed, the better will it be for all parties concerned, and not the least so for the British manufacturers of sugar machinery.

MODERN PROCESSES IN CANE SUGAR MANUFACTURE.

By Geo. Stade, Charlottenburg, 2, (Berlin).

One of the most remarkable phenomena in the whole domain of modern technical science is surely this, that amongst those interested in the manufacture, not only of beet but also of cane sugar (for instance at the Aska Sugar Works, Madras), the most contradictory opinions should still prevail with regard to a process which has now been practically in use, on a large scale, for nearly 25 years. Undoubtedly it is to the persistency of the old ingrained ideas that we must, to a very large extent, attribute the fact that even now the new method of juice extraction comes only in a very small degree into consideration as a competitor with the primitive crushing process. Truly does the famous philosopher and politico-social economist, John Stuart Mill, dec are in his "System of Logic" (Vol. I., p. 313):—

"There is no more generally acknowledged fact in human nature, "than the extreme difficulty at first felt in conceiving anything as "possible, which is in contradiction to long established and familiar "experience; or even to old and familiar habits of thought. . . . "The man of the most practised intellect is not exempt from the "universal laws of our conceptive faculty."

These reasons are, however, in no way sufficient to warrant us in making, off hand, such a general assertion as that the sugar producing countries are unable to comprehend the oft-quoted "logic of facts."

In the first place the mechanical difficulties and special peculiarities of the Robert diffusion system have probably no small share in inducing cane sugar manufacturers to observe a waiting attitude. Volumes might be written on the mistakes which have been made in the erecting of new plants of machinery. As a curiosity, we may mention that in Trinidad maceration was effected in open wooden vats; on the other hand, in Java the diffusors were cleverly emptied sideways, or rather, experiments were made to see if working could be managed in this manner, somewhat after the pattern of the refiner, who, having failed 49 times in an experiment, tried his luck once more. In other factories again they amused themselves with getting rid of the water in the diffused chips by means of the presses

ordinarily used for the beet slices; and it is hardly worth while to refer to the endless experiments made with various cane cutters. Inexperienced workmen, defective supervision, and insufficient supply of cane, have contributed (and still contribute) their quota to making estate owners and manufacturers distrustful as regards the entire process.

It may, therefore, seem somewhat of a logical contradiction, to assert, on the one hand, that diffusion of the cane has been in practical use for twenty-five years, and on the other, to point out that the grievous errors which have been committed in the setting up of new factories during this period have brought the process into discredit. However it may be remarked that the mode of setting up and working the older kind of diffusion factory can hardly be considered as a fair criterion of the existing circumstances. We may also point out that the above-mentioned individual experiments, together with a series of actively conducted very material improvements, have in the very nature of the case only come under the immediate notice of a very restricted number of those locally interested in such matters. The distances which separate the cane sugar producing countries indirectly act in preventing the manufacturers of one country from making beneficial use of the experience gained by those in another. That actual observation, which is so instructive, and that personal exchange of opinions which is so productive of action, are in a large number of cases totally non-existent; the very contrary being the case in European sugar producing countries, where most undoubtedly the close contact and union of societies engaged in this special pursuit form a most important factor in the realisation of improvements in technical working. Only a few countries form a praiseworthy exception. An objection to these remarks might be found in the fact, that specialist publications may notwithstanding do a very great deal towards meeting the defect. This is true. The possibility is there, but in this case also, the hindrances are very considerable.

In the first place, manufacturers, chemists, and engineers in these countries have a certain hesitation in making their neighbours and competitors acquainted with experiments and trails which they have made, and even where this is done, the special modes of working or improvements are of use to only a very limited circle. And again, difference of language undoubtedly places difficulties in

the way of the diffusion of specialist literature. Finally, specialist journals are still not unfrequently almost ignored, even by the most prominent among those interested in the question, and so it happens every day that experiments and processes which have long been well known, and on which they are fully posted up, *e.g.*, in Java, are at the present moment being repeated with the utmost seriousness in the West Indies, and perhaps ten years hence will be brought out somewhere else as something entirely new. Each man works merely for himself or only for a special circle, just as if the art of printing and international intercourse had no existence, and both practical and technical, as well as scientific work is still made known in the ways and by means which belong to the middle ages.

Now that the mechanical manipulations of the modern diffusion works are in every way successfully carried on, and the chemical processes of this mode of extraction follow a regular course, to the complete satisfaction of those concerned, there is nothing left for the partisan of the mill process but to call in question the success of diffusion from the financial point of view; for we cannot possibly lay to the account of the latter any consequences of any other kind to the total working of the factory, which have developed themselves after the installation of diffusion, because these might, as a matter of course, have been foreseen by any capable engineer acquainted with the system, and ought to have been taken into account *before* the adoption of the new process. Thus, for example, if a factory sets up a diffusion battery, and, in the prospect of requiring to evaporate larger quantities of water, procures a new evaporating apparatus, which, as a matter of fact, is only capable of effecting half the amount of guaranteed work, there can in such case be no talk of diffusion having failed; or, if "only two boilers" too few to supply the full motive power of the whole of the works have been put in, then it is a mere matter of fairness to refrain from reproaching the new apparatus. We are here speaking of facts which have happened only a very short while ago. In cases where for such reasons as these the battery has been abandoned, recourse being had to the old mills to finish the work of the season, the thing is perfectly intelligible, for no one is particularly willing to lose his money merely for the sake of a principle.

However, the figures which we are now about to adduce will afford sufficient proof that a factory working with diffusion is completely in

a position to hold its own with the best mills hitherto existing. The following data were first brought forward at the annual general meeting of the Hawaiian planters, held in October, 1890, and are to be found in the official "Report of the Committees on Manufacture of Sugar and Machinery," signed by two leading men practically acquainted with the cane sugar industry, Messrs. H. P. Baldwin and and J. N. S. Williams. Although we have in former articles given exact and detailed information respecting the three most important methods of manufacturing sugar cane, it will be interesting to note the exact manner in which the data thus given correspond with those here published, in spite of their being drawn up quite independently, by totally different individuals, in countries thousands of miles apart. We extract the two most important out of the four reports of working, leaving the two others out of sight, as they do not contain the figures for the total season's working, but represent merely experimental results.

A.—Factory working with Diffusion.

During the last campaign (1889-90) there have been three factories working with diffusion in the Sandwich Isles, viz.: Kealia (Kauai), employing, including the plantation, some 1,050 workmen; Hanalai (Kauai); and Hamakuapoko (Maui). There are now (1890-91) four so working.

The Kealia Central Factory has now worked three seasons with diffusion, whilst the other two are employing it for the first time. The inevitable initial difficulties presented themselves in the case of these two, but, after these were overcome, the two batteries worked perfectly, to the complete satisfaction of the managers. As regards the Kealia Central Factory, we may remark that the batteries are arranged in lines of 14 diffusors each. The clarification of the juice, as has already been stated in a former article, is effected in the most practical and simple manner in the battery itself, and so perfect is this mechanical filtration, that, during the whole campaign (45,753 tons of cane), the pure clear juice could be sent direct to the evaporating apparatus. The diffusion chips are cleared of water in the mill and fed to the furnace direct by a graduated grating. The cutting machine gave complete satisfaction and delivered nice smooth slices at the first operation. The syrup boiled easily, and the average polarisation of the sugar of all products is nearly one per cent. higher than in the case of mill-work.

STATEMENT OF RESULTS, SEASON 1889-90, AT THE KEALIA CENTRAL FACTORY, KAUAI, BELONGING TO THE MAKEE SUGAR COMPANY.

Cane worked up		45,753 metric tons.
Analysis of the cane :—		
Saccharose, per 100 tons of cane................		15·14 tons.
Normal juice ,, ,, ...		89·00 ,,
Fibre ,, ,, ...		11·00 ,,
Saccharose contained in the cane....................		6,925·45 ,,
Fibre ,, ,, ,, ...		5,033 ,,
Normal juice ,, ,, ,, ...		40,720 ,,
Analysis of the normal juice :—		
Specific gravity	1·079	
Baumé	10·6°	
Brix...................................	19·12	
Saccharose	17·01	
Purity (apparent)	88·94	
Saccharose obtained in the diffusion juice............		6,652·12 tons.
,, lost in the chips and water		274·33 ,,
Yield in saccharose, in the form of diffusion juice, per 100 tons of saccharose in the cane		96·04 ,,
Loss in saccharose, in the form of chips and water, per 100 tons of saccharose in the cane		3·96 ,,
Loss in saccharose per 100 tons of cane		0·62 ,,
Analysis of the diffusion juice :—		
Specific gravity	1·060	
Baumé	8·1°	
Brix..................................	14·55 %	
Saccharose	12·76 %	
Purity (apparent)	87·7 %	
Water added per 100 tons normal juice		31·4 tons.
,, ,, ,, cane		27·9 ,,
Total sugar (I., II., III.) obtained		6,184 tons.
Sugar (I., II., III.) per 100 tons of cane		13·51 ,,
Average content in saccharose		96·4° pol.
Saccharose obtained in form of I., II., III. sugar		5,961·11 tons.
,, ,, in I., II., III. sugar per 100 tons of cane		13·03 ,,
,, ,, in I., II., III. sugar per 100 tons of saccharose in cane		86·07 ,, [83·0] *
Raw sugar (I., II., III.) per 100 tons of saccharose in cane		89·3 tons. [88·0]

* The figures in brackets refer to results of diffusion obtained in Cuba.

Losses in Manufacture
(per 100 tons of saccharose in the cane).

274·33 tons saccharose	....Loss in diffusion....	3·96 [4·3]	tons.
791·01 ,, do.	...Loss in working and In the molasses.....................	9·87 [12·7]	,,
1,065·34	Total loss in saccharose......	13·93 [17·0]	,,

Molasses Remaining.

Approximately 1·4 per cent. of the cane.

Per metric ton of (I., II., III.) sugar about 7·4 tons of cane were required [7·7].

Consumption of Coal.

2,328 metric tons of coal were burned in the manufacture of 6,184 metric tons of sugar of all sorts from 45,753 metric tons of cane. Hence:—

Per 100 tons of cane .... 5·09 tons of coal.

Per ton of sugar (I., II., III.) . .. 0·36 ton of coal.

As the price of coal delivered at the engine-house was $10·33 = about 43s. per metric ton, the cost of evaporation per 100 tons of cane came to $52·58 = nearly £11; and per ton of sugar of all sorts, $3·72 = about 15s. 7d., or about 9d. per cwt. of sugar. (As regards the cost of coal, we may here remark that it is by no means so high everywhere as in the Sandwich Isles, the interior of Cuba, in Java, and a few other isolated colonies, which are a long way from the coal mining district. The writer once had English coal delivered at the engine-house in the West Indies at 17s. per metric ton. As a general rule coal could be obtained at 25s. per metric ton, and it is only because of the rise in prime cost and freight, caused by the strikes, that it now costs about 33s. per ton.)

A few reliable details on the consumption of coal in diffusion may be added here; this important point will again be alluded to further on.

In a letter to the *Sugar Cane* for May, 1891, dated Honolulu, 10th March, 1891, Mr. Williams states that in the present campaign a factory, working with diffusion, and making 300 tons of sugar per week, is now only using about 2 tons of coal per 100 of cane, while three other diffusion plants are using from 3 to 4 tons per 100 of cane. The first-named would, therefore, only be expending about £4 5s. for coal per 100 metric tons of cane worked up. The Britannia factory in Mauritius, according to the report of M. A. de Faymoreau, while

working up 200 tons of cane per day, used 6·75 tons of coal per 100 tons of cane, equal to 0·62 ton per ton of sugar. It should be noted that this is the first campaign in which diffusion has been worked at this factory.

B.—Factory working with Double Crushing and Partial "Maceration."

Experiments having proved that the addition of small quantities of water to the bagasse in the first crushing led to no practical result, the general practice is now to add at least 10 per cent. (The report of the Commission says 20 per cent., or even more, would be preferable.) The following figures show the results obtained by this method of proceeding. The natural consequence of this addition of water, of course, is that the bagasse will not produce sufficient steam to boil down the attenuated juice. The mode of working is that usual in such factories, and no description of it need be given here.

Results of Working,—Season 1889–1890,—at the Central Factory, Spreckelsville (Maui).

(Belonging to the Hawaii Commercial Co.)

Cane worked up	65,264 metric tons.	
Analysis of the cane:—		
Saccharose, per 100 tons cane		15·48 tons.
Normal juice		86·00 ,,
Average fibre		14·00 ,,
Total saccharose in the cane	10,102·44 metric tons.	
Total fibre in the cane	9,137 ,,	
,, juice ,,	56,124 ,,	
Analysis of the normal juice:—		
Specific gravity	1·081	
Baumé	10·9°	
Brix	19·62	
Saccharose	18·00	
Purity (apparent)	91·70	
Saccharose obtained in the mill juice	8,516·96 metric tons.	
,, lost in the bagasse	1,585·48 ,,	
Yield in saccharose in the form of mill juice, per 100 tons of saccharose in cane		84·21 tons.
Loss in saccharose in the form of bagasse, per 100 tons of saccharose in cane		15·69 ,,
Loss in saccharose, per 100 tons cane		2·43 ,,

Analysis of the mill juice:—

Specific gravity	1·072
Baumé	9·6°
Brix	17·36

Added water in maceration:—

Per 100 tons normal juice	11·2 tons.
,, ,, cane	9·6 ,,

N.B.—The mills are not constantly worked with the addition of water. There are no special figures given for the duration of the working with maceration.

Total sugar (I., II., III.) obtained	7,743 metric tons.
Sugar (I., II., III.) per 100 tons of cane	11·85 ,, ,,
Average content in saccharose	95·8° pol.
Saccharose obtained in form of Nos. I., II., III. sugar	7,411·78 tons.
Saccharose obtained in Nos. I., II., III. sugar per 100 tons of cane	11·26 ,,
Saccharose obtained in Nos. 1, 2, 3 sugar per 100 tons of saccharose in cane	73·41 ,, [72·7]*
Raw sugar (Nos. 1, 2, 3) per 100 tons saccharose in cane	76·7 tons. [77·5]

Losses in Manufacture.

(Per 100 tons of saccharose in the cane.)

1585·48 tons saccharose	Loss in mill-work ..	15·69 tons	[17·89]
1105·18 do.	Loss in working.		
	Remaining in the molasses	10·90 ,,	[9·44]
2690·66 do.	Total loss in saccharose ..	26·59 ,,	[27·33]

No details of molasses are given.

Per metric tons of I., II., III. sugar, 8·4 tons of cane were required [9·0].

Consumption of Coal.

No exact details of the whole quantity of fuel used are given.

In maceration there were burned:—

Per 100 tons cane	2·00 tons coal.
Per ton of sugar (I., II., III.)	0·17 ton ,,

Assuming, therefore, that 1 metric ton of coal cost \$10·33 = about 43s., the cost per 100 tons of cane would be \$20·66 = about £4 6s.,

* The figures in brackets refer to results of double milling and maceration.

and per ton of sugar of all sorts, $1·76 = 7s. 4d., or about 4½d. per cwt. of sugar.

Here also we may remark that the necessity for using coal at all arises from the imperfection of the existing arrangements. Even the bagasse coming wet from the mill ought, if properly dealt with, to supply the full amount of heating power the working (including the work done after the close of the campaign) required. Well appointed and properly managed factories put a portion of the bagasse on the fields as manure. If, with an addition of 11 per cent. water, coal had to be used, it is abundantly clear that, if a larger quantity of water is added, still more coal must be used, that is, assuming the old arrangements to be left as they are.

But we are absolutely compelled to have recourse to a considerable quantity of water if we want to obtain any decent quantity of juice, that is, as far as this is really after all realisable with crushing plant on a large scale. But if the intention is to work only with dry crushing, the maximum yield of juice obtainable is, and will remain, only about 73 per cent. of the cane. There is no likelihood of getting above this figure, for the forces of nature cannot be overcome with such comparatively fragile and imperfect apparatus as even the best modern mills are. Sundry cane mill manufacturers are fully aware of this, and the newest mills, "far surpassing anything yet offered," which are now being constructed in England, are only guaranteed to get 74 per cent. crop average.

According to the latest advices from Hawaii, which state that with an addition of 16·2 per cent. of water and crushing in three pairs of two roller mills of the most powerful kind there has still been a loss of 9 per cent. of saccharose in the bagasse—it is at least doubtful whether the above-named extraction will be attained with dry grinding. We have now also details of the results obtained, in last campaign, by eight factories, which with an addition of 22½ per cent. water and double crushing only show an extraction of 90·8 per cent., so that there was still left in the bagasse 9·2 per cent. of the saccharose contained in the cane.

As a further proof of the inevitable loss connected with mill-working we may here give the results of experiments made by Mr. Edm. Riffard. This well-known authority on matters connected with the Colonial sugar industry made, some ten years ago, very complete experiments on this important point. (See *La Sucrerie Indigène et*

Coloniale, 1883, II., page 567: Influence de la proportion d'eau ajoutée à l'imbibition sur l'extraction du jus normal de la canne à sucre.) The result of his experiments was as follows :—

Per 100 Tons of Cane.

	TONS.
Exp. No. 1.—64·92 tons of normal juice—obtained by single crushing without addition of water—Loss of saccharose in the bagasse..................	4·10
Exp. No. 2.—76·45 tons of normal juice—obtained by double crushing, with addition of 12·19 tons of water per 100 tons of cane—Loss of saccharose in the bagasse	2·22
Exp. No. 3.—77·12 tons of normal juice—obtained by double crushing with addition of 36·09 tons of water per 100 tons of cane—Loss of saccharose in the bagasse	2·10

"This appears to be the right place to correct, or rather amplify some remarks which Prof. Hermann Paasche, of Marburg, makes on quoting the sketch, "Aus dem Betriebe einer Rohrzuckerfabrik, &c.," in his excellent work, "The Sugar Industry and Sugar Trade of the World." In this lately published book the following statements are made :—

(*a*.) Page 216, line 6, &c., "The total amount of first, second, and third sugar obtained was 9·435 per cent. of the weight of cane."

This is not the case. In the article in question there stands, page 1508, "Per 100 tons of cane :—The total yield obtained in first, second, and third sugar is, therefore, 10,048 tons=77·45 per cent. of the massecuite No. 1." Further, on page 1510, "As stated above, the yield in saccharose in the shape of raw sugar, per 100 of cane, was 9·435."

There is here a confusion between saccharose and raw sugar.

(*b*.) Page 216, line 13, &c., "Here the amounts to be written off are not counted, but the new additions (machinery, &c.,) are included in the cost of working."

Here must be noted that a remark is expressly made in a foot-note, on page 1509, to the effect that for this reason these figures do not admit of being accurately compared with similar European data.

According to information which has since reached the writer, the amount expended in construction of the central factory in question has already been written off. Fresh additions of machinery, &c., were always taken, after the English fashion, under working cost, in case the amounts were not very large.

(c.) Page 215, line 26, &c., "The value of the cane fields is given in a German consular report for 1884 at about 1200 marks per hectare."

These are quotations referring to the crisis of 1884, but are now totally inapplicable even to Barbados and Cuba, and much less to be applied to the case which we had here before us. The prices of land are at present very low and there are cases where for 1250 acres of good cane land, including factory and dwelling-house, &c., only some £5000, or less, have been paid. On the other hand it may be remarked that the upset Government price for crown lands is £1 per acre.

(d.) Page 215, line 19, &c., "The cost of carriage to the mill, per cwt. of cane is 20·2 pfg.; it is not quite clear whether this is inclusive of interest and sinking fund, but the amounts stated (5·9 pfg.) are somewhat low."

The same remark as made under b. is also applicable here as regards sinking fund. But, it may be further remarked, that, as may be seen accurately in Table 1 (General Cost of Agricultural Management), No. 4, the amount of 5·9 pfg., which was considered too little, does not refer at all to the department of carriage, but simply to the case of labourers' hospital, and insurance in the agricultural department. Carting and cultivation are kept absolutely apart from each other, and only placed together in Table 5, B., for the sake of comparison.

Anyone who does not understand how to make use of the figures given by Mr. Riffard, together with the exact figures relating to the yield of a three-roller mill (see *Sugar Cane*, 1890, 131), will be very unlikely to be in a position to gain by means of calculation any clear idea of the profit or loss of technical processes in general. To the initiated it will, however, be quite evident that there is a large number of "practical people" to be found amongst the producers of raw sugar who have eyes to see but do not want to see. Nothing can be done with such people, even though any amount of accurate calculations are brought to bear. These gentlemen will act precisely in the same manner as the planters of a certain South American colony, when it was positively proved to them, by figures from actual working, that the steam-plough would do their work fully two shillings per acre cheaper than hand labour, and yet, up to to-day, it has never occurred to them to make use of the superior method of cultivation.

The only possible way of attaining an extraction that can in any degree compete with that of diffusion, is by the use of much more powerful crushing apparatus and still larger addition of water. The result will, therefore, as regards the quantity of the attenuated juice, approximate more and more to that of diffusion. Engine-house, evaporating plant and machinery would hence have to be erected on a corresponding scale, and so the vaunted advantage of this method, that of being able to work with small evaporating plant and with a small heating surface, disappears altogether. Even if we assume that both processes (maceration as well as diffusion) can use exclusively their own bagasse as fuel,—and that is, undoubtedly, practically feasible,—and, therefore, work entirely without wood or coal, there is, after all, another extremely important factor to be taken into consideration in the comparison. This is, the interruption of working by breakdowns of rollers, headstocks, pinions, &c., which, in the case of diffusion, are almost entirely avoided. As the work done by the mill apparatus is in inverse ratio to the co-efficient of safety of the materials of which it is constructed, it follows that with relatively good working (which is identical with working at full strain) the steady and safe course of operations is very materially affected; and anyone who has once been a witness of such complete collapses of the strongest case-hardened rollers, and has calculated the pecuniary losses resulting therefrom, will not, now that the spectre of "inversion" in connection with the diffusion process has long vanished into thin air, be a moment in doubt as to which method of obtaining the juice should have the preference.

A very favourite way of praising up the mill work is to point to the poor quality of the juice in the bagasse; but this also is an illusion, at any rate so far as juice with quotient of purity of more than 80°/₀ may be regarded as worth working up. No one doubts that the juice remaining in the cane after crushing is of somewhat poorer quality than the product of extraction. This is easily explained by the structure of the cane; for if cane is subjected to a gentle crushing, the communicating cells in the centre of the stem are the first of all to be opened, and these contain a comparatively large quantity of water; under a firmer pressure, the juice of medial cells, which contains a large quantity of sugar, is expressed. Finally, if the cane is completely crushed, the cells lying nearest to the rind are burst, and their juice contains more or less silicic acid, and (as proved by

the following figures) is of a rather lower degree of purity than the other two juices. This explains the whole phenomenon, and there is nothing remarkable about it. But it has long ago been proved that the difference in the purity of the various juices is by no means so important that it could be thought better not to extract the sugar left behind in the bagasse. The investigations of Dr. Winter, and also the previous labours of Mr. Ph. Boname (Mededeelingen van het Proefstation voor suikerriet in West Java. Ph. Boname, Culture de la canne à sucre) prove this to demonstration. The following figures represent extreme cases:—

1.	Juice in the rind	80·97	per cent. actual purity	Mr. Boname.
	,, ,, pith	87·94	,, ,, ,,	
	,, ,, knots	91·36	,, ,, ,,	
2.	Juice in the joints	90·94	per cent. apparent purity	Dr. Winter.
	,, ,, knots	89·79	,, ,, ,,	

A sample taken from actual working gave the following results:—

Juice (66 per cent. crushing) .... 85·1 per cent. apparent purity.
,, (74 ,, ,, with maceration) 84·7 ,, ,, ,,

Another argument brought forward in favour of mill work is the statement that the juice extracted by double crushing really contains very nearly the whole of the sugar.

As this famous assertion is in direct contradiction to all experience and to all the investigations hitherto made, it scarcely deserves to be treated seriously, and therefore one can only heartily pity the Colonial chemists who try to invalidate the results of scientific research by means of these totally unsupported statements, in order to conceal their own incompetency.

In conclusion, we may remark that a certain secret longing is visible in many papers, newspaper paragraphs, pamphlets, &c., which hails, with evident satisfaction, the failures of diffusion in a few defectively-constructed or managed establishments. Would it not be better if they would examine more closely into facts, for there is no gain in the long run in acting like the ostrich.

One has no need to be of an over-sanguine nature to come to the conclusion, after due consideration of the foregoing data, not merely existing on paper, but obtained from the results of practical working, that the Robert Diffusion Process in the Colonies has finally got over the diseases of childhood. Every impartial reflecting man, technically

acquainted with the subject, must now unreservedly confess that in every case where the whole establishment has been intelligently arranged, and no half measures have been adopted in modernising the entire plant—but only in such cases—the process has been crowned with splendid success. The new plants in Hawaii, Java, Mauritius, Louisiana, &c., prove this. But without a total and thorough revolutionising of the arrangements for supply of cane, evaporation, the boiling-houses, and last, but not least, the technical management, it will, in ninety-nine cases out of a hundred, not turn out well. And in this consists the principal obstacle, which, together with the reasons adduced at the commencement of this article, for the present prevents, to a great extent, the universal adoption of the process. For, supposing that a factory possessed all the other technical essentials for setting up diffusion, and the owner were really willing to turn thought into action, but capital or (as the case may be) credit were not procurable to the extent absolutely necessary, then the whole thing would come to nothing. By the time that this state of things in the Colonial sugar-producing countries has been so far changed that a thorough realisation of the idea of obtaining 90 per cent. of the saccharose in the cane in the form of commercial sugar (instead of, as now, 50 to 75 per cent.) can be believed in,—to quote Dr. Paasche's very apposite remark—"the increase in consumption will have furnished eager purchasers, even for such an extra production."—(*The Sugar Industry and the Sugar Trade of the World*, page 221.)

ON THE METHODS OF EXTRACTION IN USE IN MAURITIUS.

[We have received from M. Th. Stéphanon, engineer at the Forges et Fonderies, Mauritius, a pamphlet with the above title ("Etude Comparative sur les divers moyens d'extraction employés à Maurice") which we consider so interesting, in view of the great attention which the question of Diffusion *v.* Mill-work is now attracting, that we shall be rendering good service to our readers by translating it *in extenso*, which we at once proceed to do.]

In Mauritius we have at present three methods of extraction in use. The first is that of double-crushing by two mills placed one in front of the other, the second of which serves to grind over again the bagasse resulting from the canes crushed by the first. This is the method most generally employed.

The second consists in the employ of one or more horizontal troughs in the form of a U attached to the second crushing mill, in which the bagasse is steeped for a greater or less period of time before being passed through a third mill. The juice coming from this third milling returns into the troughs, a certain quantity of water, varying with the richness of the cane, being added to it. The overflow, more or less saturated, about equal in volume to the water added, is either treated separately, or mixed directly with the juice coming from the double-crushing.

This method is in use in seven or eight sugar works, and in some of them has been so for several years.

We prefer, let us say at once, the system of U shaped troughs; we believe that in this system the bagasse comes most closely into contact with the water, and so remains constantly for a longer time, and the extraction of the sugar is more methodical, the water being compelled to follow a direction opposite to that taken by the bagasse.

Finally, the third method is that of diffusion of the cane cut into chips. This system has only been in use for one year on the "Britannia" estate belonging to "The Oriental Bank Estates."

We shall omit any notice of a few scattered works, which still use only single crushing, as these are of no moment to the present discussion.

Having stated the three principal systems of extraction, we shall proceed to compare them one with another, taking as basis an equal weight of cane manipulated in all three cases, and the same saccharine richness of the cane for all.

We will take as the weight of canes 24,000 tons for the season, and the saccharine richness as 14 per cent., being that ascertained at "Britannia" during the last two months of the crop. The results of working at "Britannia" having been published, we shall avail ourselves of them.

As regards the first method, we are compelled to take a hypothetical factory, and determine what ought to have been the yield obtained with canes of the average saccharine richness of 14 per cent. We shall determine the density and the degree Baumé corresponding to this saccharine content according to the following formulæ:—

1. $S = 1{\cdot}70\ (B - 2{\cdot}30).$

2. $S^r = \frac{2{\cdot}91\ (R - 1{\cdot}62).}{d}$

These formulæ have been determined by M. L. Biard, the chemist, whose capability in all such matters is indisputable. In these formulæ, the letters have the following values: S = sugar per 100 kilos. of cane; S^p = sugar per 100 kilos. of juice; B = degree Baumé; d = density at 15° C. (59° F.); R = degree of the excise $= \frac{d - 1000}{10}$.

The degree B which we shall find to correspond with a saccharine richness of 14 per cent., will be higher than that noted at "Britannia" for canes of this quality. This is attributable to the fact that the density of the juice obtained directly by crushing is always greater than that of the juice obtained from cane chips. The same fact has been also observed in beet-sugar factories. In proof of this we may instance the co-efficient of 0·86 employed by M. Roy (chemist at "Britannia") to determine the saccharine richness of the cane where the richness per 100 kilos. of juice is known, and that of 0·83 (determined by M. Biard) to determine the same richness where the richness per 100 kilos. of juice from the first mill is known.

For more ample details we would refer the reader to a remarkable paper published by M. Biard, in the *Revue Agricole de Maurice.*

It must be understood that the preceding remarks apply only as referring to works using double crushing, in the present case, as we have said, a hypothetical factory. In the two other cases we have at hand all the information necessary for this discussion.

We will now determine the density and the degree B corresponding with a saccharine content of 14 per cent., so that we may not have to recur to this part of the subject, and also the sugar per 100 kilos. of juice. Using the formula No. 1 we have $S = (B - 2{\cdot}30)1{\cdot}70$, or, knowing S to be equal to 14, $S = 1{\cdot}70\ (B - 2{\cdot}30)$, hence $B = \frac{14}{1{\cdot}70} + 2{\cdot}30 = 10{\cdot}535$.

The density corresponding to this degree B is 1078·8 and R is equal 7·88.

Formula No. 2 gives us—

$$S^p = \frac{2{\cdot}91(R - 1{\cdot}62)}{d.}; \text{ hence } S^p = \frac{2{\cdot}91(7{\cdot}88 - 1{\cdot}62)}{1078{\cdot}8} = 16{\cdot}88.$$

Knowing therefore the degree B, the richness per 100 kilos. of cane, and the richness per 100 kilos. of juice, we have only to ascertain what should be the extraction, and the yield obtained at a factory working with double crushing.

First Case.

Works using double crushing by mills placed one in front of the other, the second grinding the bagasse which comes from the cane crushed by the first.

We will suppose this factory supplied with all the latest improvements, consequently possessing triple effect, vacuum boiling pans, turbines, &c. Daily quantity of cane worked up, 240 tons. This is the capacity of a good factory at Mauritius. We have therefore for one day's work:—

Weight of cane	240 tons.
Density	1078·80
Baumé	10·535
Sugar per 100 kilos. of cane	14
Do. do. do. of juice	16·88
Percentage of crushing	66
Extraction $\frac{16 \cdot 88 \times 66}{100}$......	11·14
Loss in the bagasse	2·86

We have assumed a crushing of 66%, which we consider to be the average of the good crushing obtained in Mauritius. Some factories (one or two), however, show 70%; we have never had an opportunity of verifying the fact, though we accept the statement without hesitation, merely congratulating those who can get so good a result.

We have therefore an extraction of 11·14% on the weight of cane put through the mill; what is the yield? It has been found that in those factories which worked well the quantity packed was equal to 0·84 of the sugar extracted, and we have no reason for not reckoning our hypothetical factory amongst them; we shall then have—quantity packed $= 11 \cdot 14 \times 0 \cdot 84 = 9 \cdot 35$.

We see that a factory working with double crushing can recover 9·35 kilos. out of 14 kilos. of sugar contained in the cane, that is $\frac{9 \cdot 35 \times 100}{14} = 66 \cdot 78\%$ of the total sugar. The daily out-turn of this factory working up 240 tons of cane per day will be $\frac{240 \times 9 \cdot 35}{100} =$ 22·44 tons, or, for the season of 100 days, 2,244 tons.

Second Case.

Double crushing, methodical maceration of the bagasse in U-shaped troughs, re-crushing of the bagasse in a third mill, with return of the juice of the third crushing into the working.

Four factories at Mauritius employ this method of extraction; among these we will take as the typical factory that of "Rich Fund,"

belonging to MM. A. Armand & Cie, situated in the higher part of the Flacq district, and working up cane received from various quarters, largely from the higher lands.

The year which has just closed was not a trial year as regards this factory, which has employed this method of extraction for four years, and always with the same results; that is to say, the difference between the saccharine richness of the cane and the sugar recovered, has not varied sensibly during the four years. We have been fortunate enough to obtain details of the working of the factory for the last campaign, and we shall use this information and the results obtained in the statements we are about to make.

The "Rich Fund" factory worked up, during the last campaign, 22,977,045 kilos. (say 22,977 tons) of canes, the net production of sugar being 2,489,532 kilos. (say 2,489½ tons) of sugar. This gives as sugar obtained per 100 kilos. of cane:—

$$\frac{2{,}489{,}532 \times 100}{22{,}977{,}045} = 10{\cdot}83$$

It remains then to determine what was the average richness of the canes during the campaign.

The average density of about 2,000 tests made during the whole campaign was 1,074 at 15°C. (59°F.), corresponding with 9·94 Baumé. Calculating the richness of the cane by formula No. 1, we have $S = 1{\cdot}70\ (9{\cdot}94 - 2{\cdot}30) = 13$. The quantity packed having been 10·83 % kilos. of the cane, we see that the loss was $13 - 10{\cdot}83 = 2{\cdot}17$, and that the sugar recovered represents $\frac{10{\cdot}83 \times 100}{13} = 83{\cdot}30$ per cent. of the total sugar contained in the cane.

But in order to establish a comparison between double crushing and diffusion we must deal with equal saccharine content in the canes. The difference in saccharine richness between the canes worked up by diffusion and by double crushing, and those worked up at "Rich Fund" was $14 - 13 = 1$. As we have seen, at "Rich Fund" they recovered 83·30 per cent. of the total sugar contained in the cane, they should have obtained, from canes having 1 per cent. more saccharine richness, an extra quantity of $\frac{83{\cdot}30}{100} \times 1$. We will take only 75 per cent. of this excess. "Rich Fund" would then have obtained as yield from canes testing 14 per cent. of sugar:

$10{\cdot}83 \times \frac{75 \times 1}{100} = 11{\cdot}58$, which is equivalent to a loss of $14 - 11{\cdot}58 = 2{\cdot}42$.

What would have been the daily out-turn at "Rich Fund," working up 240 tons of canes testing 14 per cent. of sugar? We have:—

Cane worked up, 240 tons.

Sugar recovered per cent. of canes, 11·58, and for 240 tons, $\frac{240,000 \times 11·58}{100} = 27,792$ kilos. (say 27·8 tons), and, for 100 days working, 2,779,200 kilos. (say 2,779 tons) of sugar.

"Rich Fund" would then have recovered $\frac{11·58 \times 100}{14} = 82·71$ per cent. of the total sugar contained in the cane.

If we compare this result with that obtained by double-crushing, we see that the excess of sugar obtained by the process of methodical washing (maceration), is 2,779,200 — 2,244,000 = 535,200 kilos (say 535 tons).

So much for the yield. But then there is the outlay in fuel which must not be overlooked.

The bagasse, dried in a special apparatus, and the "straw" obtained from the cane on the estate, were not sufficient, especially considering that the planters' cane only supplies the bagasse as fuel, the straw (or "trash") of these canes not reaching the factory. An additional quantity of fuel was therefore necessary to supplement the bad quality of the bagasse, the "trash" lost in the case of "planters' cane," and to evaporate the excess of liquid caused by the addition of water in the maceration.

This was as follows:—

	Rs.
224 cords of wood @ Rs. 15·82 delivered at the works	3,544·26
800 cords of forest timber @ Rs. 8·54	6,830·50
73 tons of coal @ Rs. 34·56................	2,522·60
	12,897·36

for the 22,977,045 kilos. of cane worked up. Which for each 100 kilos. of cane comes to: $\frac{12,897·36 \times 100}{22,977,045} =$ Rs. 0·056, and for 24,000,000 kilos of cane worked up in 100 days:—

$$\frac{24,000,000 \times 0·056}{100} = \text{Rs. } 13,440.$$

Another factory, using the same method of extraction as "Rich Fund," obtained, as we are informed, 9·45 with a saccharine richness in the cane of about 12·50. As will be seen, the total loss is 3·05 (12·50—9·45). The expenditure for fuel is about the same as at "Rich Fund."

A third factory obtained 9·53 with a saccharine richness (calculated on formula No. 1), equal to 12·70. This gives a total loss of 3·17 (12·70—9·53). The expenditure for fuel in this factory was Rs. 0·13 per 100 kilos. of cane worked up. This expenditure is evidently too high, and might be somewhat reduced. The causes of such a high rate of expenditure are—(1) The absence of "trash" as fuel; (2) too frequently repeated additions of water. The factory crushed for two days and then suspended work to get more cane brought up to the mill, hence it was necessary to concentrate (and often to boil the juice obtained) on the third day, consequently to use up fuel without producing any. This operation, repeated twice a week during half the entire season, was anything but economical. It must not be forgotten that the best form of working requires regularity, and especially continuity.

Finally, the fourth factory employing this method obtained only a figure calculated at 9 per cent. with canes of 13 per cent. saccharine richness. This result is, we must say, deplorable. The explanation is as follows: The apparatus placed between the second and third mill for the maceration of the bagasse was calculated to be equal to 21,000 kilos. of cane per hour. But the quantity of bagasse passed into it per hour came from 26,000 to 27,000 kilos. of cane, *i.e.*, 25 to 30 per cent. more than the proper quantity. The bagasse, squeezed too tightly between the carrying boards, could scarcely be got out at the place of exit; the water did not circulate, or circulated with difficulty, through the closely-pressed bagasse; it was impossible to add the proper quantity of water for fear of overflow. Hence there was every factor necessary for producing a failure of results, for without water no sugar can be extracted. This is but too true, and we feel vexed too have to record such a fact. We merely mention it, but the cause is known and may be avoided in future, and we are sure that next season, by regulating the working, and only putting into the apparatus the quantity of bagasse for which it was constructed, the results will be such as they ought to be.

A fifth factory, supplied with the same apparatus, and working in the same way as the one just mentioned, gave up the process after one season, being surpised at not obtaining good results, while they might well have been surprised if the contrary had happened. As a consequence, the bagasse was almost useless as fuel; however we have the temerity to think that cane is cultivated for making sugar and not firewood, and therefore attach no importance to this failure.

Third Case.

Extraction by diffusion in closed vats of the cane cut into chips.

The only factory at Mauritius employing this process is that of "Britannia," belonging the Oriental Bank Estates Company. The plant, manufactured by the Compagnie de Fives-Lille, was erected last year under the direction of M. J. R. Cohu, the engineer of the company. It has therefore only worked for one season.

It would be rash to take a single year's working as a basis for definitely settling the general results which may be expected in the future. The two first month's working ought also not to be taken into account. We shall deal only with the two last months, the results of which have appeared in the *Revue Agricole de Maurice*. These results were very satisfactory as regards the extraction of sugar from the chips, and we doubt whether it will be possible to do better without incurring very great expense.

There is only the question of fuel which cannot very well be settled after only one year, so we will not take the figures given in the published results of the two last months, and will give the "Britannia" works the benefit, as regards fuel, of the results obtained elsewhere.

In the results published in the *Revue Agricole* of January, we find, as a matter of fact, that the quantity of coal burned per ton of cane worked up, was 67·56 kilos or 6·75 per cent. This figure may eventually be reduced, and we shall only reckon 5 kilos of coal to 100 kilos of cane, which is the average figure for factories using diffusion, and burning the dried chips and leaves.

The following are the published results for the two last months of the season at "Britannia":—

	Kilos.
Cane worked up	9,238,948
Sugar obtained	1,081,142
Do. do. per 100 kilos of cane	11·65
Sugar in 100 kilos of cane	14
Total loss	2·35

The average loss in the chips having been 0·35 per cent., we find that the loss in working was 2 per cent. of the weight of cane. This loss may perhaps eventually be reduced, but this will depend on the working of the factory and the quality of the sugar made.

In order to be able to compare these results with those of the two former methods, we shall calculate the manipulation as for 240,000

kilos. of cane per 24 hours and 100 days working. We shall then have as the days' working:—

Cane worked up	240,000 kilos
Extraction............................	11·65
Sugar manufactured	27,960

And for 100 days' work, 2,796,000 kilos. of sugar of all grades.

Calculating the proportion of sugar recovered on the total quantity contained in the cane we have:—

$$\frac{11\cdot65 \times 100}{14} = 83\cdot2 \text{ per cent.}$$

And comparing this result with those obtained by the two other methods of extraction, we find that the excess of sugar obtained by diffusion over double-crushing is 2,796,000 — 2,244,000 = 552,000 kilos., and over maceration, 2,796,000 — 2,779,200 = 16,800 kilos.

So much for the yield obtained; there now remains the question of fuel. We have already said that we shall not take the figure of 6·75 per cent., because that of 5 appears to us the figure for the future. For 24,000,000 kilos. of canes we shall then have a consumption of 1,200 tons $\left(\frac{24,000,000 \times 5}{100}\right)$

We shall not take the price of coal as Rs. 34·56, as in the case of "Rich Fund," because the railway runs right into the "Britannia" factory, avoiding the cost of unloading, &c., so we will deduct Rs. 4·56, which will bring the coal to Rs. 30 per ton. The expenditure will then be 1,200×30=Rs. 36,000. In addition to this outlay for fuel, there is an additional expense at "Britannia" for extra labour in night working and for the increase in the number of those employed. We have no data on this head, but believe it may be calculated, without risk of exaggeration, at Rs. 5,000 for the whole season. This brings the extra expenditure for coal and labour to Rs. 41,000.

It must be remembered that this is for working up 24,000 tons of canes.

COMPARISON OF RESULTS.

We now have all the elements necessary for comparing one with another the three methods of extraction which we have described. We have first:—

Excess of sugar obtained by diffusion over ordinary double crushing	Kilos. 552,000
Which, sold at Rs. 20 per 100 kilos., give a profit of	Rs. 110,400
Deduct for additional cost of extra fuel and labour................................	41,000
Net profit................	Rs. 69,400

Excess of sugar obtained by double-crushing and maceration over ordinary double-crushing	Kilos. 535,000
Which, sold at Rs. 20 per 100 kilos., give a profit of	Rs. 107,040
Deduct for cost of extra fuel................	13,440
Net profit................Rs.	93,600

From the figures already obtained it appears that diffusion, from a financial point of view, is not more profitable than maceration (*lavage méthodique*). Admitting, for the moment, that the advantages are the same as compared with ordinary double-crushing, there is as yet no advantage in employing diffusion. It is possible that our figures may be disputed, and we expect they will be, but to what an extent must they be distorted to enable the profit of diffusion over maceration to equal the interest of the enormous capital required for setting up a diffusion plant!

[M. Stéphanon then proceeds to quote the conclusion of a writer in the *Sugar Cane* of January, 1891, which will be found on pages 43 to 46 of that month's issue. He also refers to the latter portion of the letter of Mr. F. Scard, of Demerara, which appeared in this journal in February, 1891, and will be found on page 96 of that month's issue; it is therefore unnecessary to transcribe these, as our readers can refer for themselves.—Ed. *S. C.*]

From what has been stated, and the extracts which we have quoted, we draw the following conclusion:—

For a factory possessing a good double-crushing mill accompanied or preceded at the second mill by an energetic and methodical system of maceration, there is no gain, from a financial point of view, in adopting the diffusion system. We remarked, in the preface, that our opinion was based on facts under our own eyes, the results which we have now adduced only confirm this opinion.

We hope that this modest work may be read without prejudice, as we have also written it, and that planters and estate-owners will not allow themselves to be "hypnotised" by the word "Diffusion," but will look more carefully about them, for they have within reach of them all that is necessary for success. We shall persist in our conclusions until they are formally contradicted by actual events, and to those who would say, "Hors de la diffusion, pas de salut" we reply "The salvation of the planter is where he gets his profits, and these are not in the direction of diffusion, at any rate at present."

Comparative Table of the Expenses and Profits with Maceration and with Diffusion for 24,000,000 Kilos. (24,000 Tons) of Cane.

	Fuel per cent of Cane.	Fuel for 24,000 tons Cane.	Extra Labour (calculated).	Total Expenses.	Excess of Expenditure over Maceration.	Profit of Diffusion over Maceration.	Difference in favour of Maceration.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Lavage méthodique (Maceration)..	0·056	13,440	....	13,440	....	....	24,200
Diffusion	0·150	36,000	5,000	41,000	27,560	3,360	....

Comparative Table of Yields, in Three Factories, working up 24,000 Tons of Cane, in 100 consecutive Days.

	Sugar per cent of Cane.	Sugar obtained per cent. of Cane.	Total Loss.	Daily Turn-out.	Excess in yield over Double-crushing	Excess in yield over Maceration.	Production for 100 days.	Excess over Double-crushing	Excess over Maceration.	Profit: Sugar being quoted Rs. 20 per 100 kilos — Excess over Double-crushing.	Profit: Sugar being quoted Rs. 20 per 100 kilos — Excess over Maceration.
				K.	K.	K.	K.	K.	K.	Rs.	Rs.
Double-crushing	14	9·35	4·65	22,440	..	..	2,244,000	....	....	....	....
Lavage méthodique ..	14	11·58	2·42	27,792	5,362	..	2 779,200	535,200	....	107,040	....
Diffusion	14	11·65	2·35	27,960	5,520	168	2,796,000	552,000	16,800	110,400	3,360

CUBA.

The Manoury Process for Working up the Molasses.

The following is translated from the *Imparcial* of Cienfuegos:—

"At the Constancia central factory, thanks to the intelligence and activity of M. Manoury, surprising success has attended the process of using the molasses (previously prepared in a tank) to moisten the bagasse which has to be crushed over again, the juice in the second milling becoming perfectly mixed with the molasses, the liquid then being at once subjected to the usual operation, a description of which is unnecessary. We confess that we entertained a prejudice against this process, which was due partly to the inaccurate information which we had concerning it, and partly to our becoming aware of certain difficulties which had arisen between Messrs. Apezteguia and the American Trust which had purchased a portion of the 20,000 sacks which had been produced at the 'Constancia.'

"Now that we are in full possession of the facts, we cannot do less than congratulate M. Manoury on the brilliant result obtained in increasing the yield without injury to the product. In the magnificent laboratory of the 'Constancia,' we have gone through the polarisations of nearly all the various workings, and convinced ourselves that not one of them has been under 96°, and that many of the samples polarised above 97°.

"The chemical analysis also shows that the sugar is of excellent quality. The difficulties with the Trust, already mentioned, were caused by the dark colour of the sugar, but this defect was afterwards obviated, and the samples of sugar which we examined are in no way behind the best products turned out in the most improved factories.

"We believe that next season a large number of estates will be using the process which may be called the "Manoury," obtaining a yield which some years ago we should have thought very improbable.

"We are not going too far in anticipating that cold defecation and other reforms, which will be introduced during the next campaign, will undoubtedly considerably reduce the cost of production, if the results on a commercial scale should turn out as favourable as they have proved to be in the laboratory."

The following is from the *Havana Weekly Report*:—

The New York Trusts *vs.* the Molasses Process.

In several of our previous issues we have mentioned the dissatisfaction which the determination of the American Sugar Refining

Company, regarding the rejection of all sugars manufactured with cane juice mixed with molasses, had caused here, and the complaints of planters have given scope to the publication of articles which may be briefly summarised in the following manner:—

The fact is, that the determination of the Sugar Trust, as published by their agents here, is rather rough, absurd, and inopportune.

We understand that said company should reject first jet sugar chemically manufactured or prepared by any process in which extraneous matters are employed; but we are at a loss to understand the reason why they should refuse to accept sugars containing a larger or smaller quantity of molasses; to pretend such a thing, is the same as to endeavour to overthrow all the established laws and customs referring to commerce and manufacture.

A fact known to everybody, is that sugar may contain a small quantity of molasses without losing the slightest part of its qualities, because this merely consists in its having been more or less purged or the defecation or granulation having been somewhat neglected; though sugars of No. 11 D. S. contain more molasses than those of Nos. 13 and 14, it does not mean, in the least, that the former are inferior to the latter.

In all times and at all places, inferior and superior sugars have been manufactured, but this does not imply the rejection of the lower grades by the American buyers. Some sugars may be of superior quality, although they contain a small quantity of molasses, and others may be good for nothing, although not a single drop of molasses could be found in them.

If the sugar containing molasses is natural and only contains the compounds of pure sugar, it ought to be accepted and paid for according to its saccharine richness, as has heretofore been done. Molasses sugars and muscovadoes contain more proper impurities than centrifugals, and the American refiners, notwithstanding, have always accepted them. For the same reason centrifugaled sugars, manufactured without chemical agents, testing from 94 to 98 degrees, according to the care and cleanliness with which they have been manufactured, ought to be dealt with in the same manner as all their similars.

If, on one side, the American refiners have the right to reject sugars containing substances extraneous to cane juice, on the other part it should be denounced as an arbitrariness and injustice that they should refuse to accept those manufactured without dextrine or any other chemical agent to improve their polarization or to crystallise the molasses therein contained.

The American refiners receive no prejudice by purchasing sugars containing more or less "natural" impurities, because the polarisation, which is the basis on which the price is established, never varies.

We are totally unaware of the purpose the powerful American Sugar Refining Company are pursuing, in trying to abolish the commercial regulations heretofore observed over the world, and we are inclined to believe either that their determination has been adopted through some misunderstanding, or that it has been erroneously interpreted by their agents at this place.

Crop Reports and Plantation News.

As only few centrals, compelled by contract to grind the totality of the cane of their tenants, are still at work, it may be said that the crop is virtually over on this island.

The weather continues very favourable to the growing cane, which, despite the lack of attention in many fields, is doing well.

The first contracts of cane for the next crop have already been closed at prices and conditions which were not made known, and comprise 5,000,000 arrobes from some tenants at Aguada de Pasageros, for centrals "Santo Catalina," of Coffigny and "Santa Gertrudis," af Mendoza.

In order to obviate the scarcity of field labourers, planters intend to bring from Buenos Ayres some of the Spanish emigrants without work there, on account of the financial crisis.

On the 13th ult. estate "San Joaquin," of Count Ibanez, on which, as it is known, the diffusion process has been established, terminated its crop.

It is stated that the yield is satisfactory, inasmuch as 5,110,713 arrobes (50,230 tons) of cane were diffused, and produced 38,313 bags of first jet centrifugated sugars, and 3,707 bags of molasses sugars of second jet, which, at 308 pounds net each, form a total of 472,385 arrobes (4,720 tons) of centrifugals, and 45,670 arrobes (457 tons) of molasses sugars, or 5,181 tons of both classes.

The first jet yield was 9·24 per cent., and that of the second 0·88 per cent., adding up for both jets 10·12 per cent.

As there still remains a certain quantity of molasses to be worked, which is calculated to yield about 3,000 bags more of sugars, these will bring up the total production to 555,015 arrobes (5,750 tons), and the average yield of the juice to 10·85 per cent., the yield thus falling 1·15 per cent. below the 12 per cent. said at first would be obtained, leaving in the bagasse only 3·04 per cent. of the sugar in the cane.

JAVA.

British Consular Report on the Sugar Production and Commerce of the Island for the Year 1890.

The past year may be considered as having been a decidedly favourable one for this the most important branch of industry of the island. Prices ruling during the season, although by no means high, were still on such a level as to be fairly remunerative to planters, and the quantity and general quality of the crop were decidedly satisfactory.

The total production amounted to 400,000 tons, or 10,000 tons more than the largest crop ever before made, say 390,000 tons in 1885.

From Soerabaya, the centre of the principal sugar growing districts of the island, Mr. Vice-Consul Warren reports as follows:—

The good results experienced during the past year are in a great measure to be ascribed to a much more extensive use of manures, principally sulphate of ammonia, of which large quantities have been imported, combined with a more careful cultivation and deep working of the soil.

The introduction of new and improved machinery appliances into many manufactories has also tended to lower the cost of production.

No extension of the diffusion process has taken place, the difficulties as to the use of chips for fuel not having yet been satisfactorily overcome.

Three or four new manufactories have been started in this end of the island, and will commence working during 1891 and 1892.

As regards the "sereh" disease, it is satisfactory to record that the precautions adopted for mitigating the effects of the disease have proved in general fairly successful, and the production has not been seriously affected by it as in previous years, the disease appearing more in a sporadic form as compared with the virulent tendency formerly exhibited in some districts.

No new theory has been mooted as to the cause of the disease, but the best method of treatment hitherto discovered is, undoubtedly, the planting of carefully selected healthy cane shoots. As mentioned in my last report, in the residency of Djocdjakarta 500,000fl. were spent in obtaining suitable cane cuttings for planting, and the production in that district shows an increase of about 9,000 tons for the year.

In the coming crop the canes as yet show little trace of "sereh," and should the weather be favourable a full crop may be expected; at present, however, most of the eastward districts are suffering from drought, the west monsoon having not yet fairly commenced.

The exports to various countries during the three years previous to 1890, exclusive of molasses, were as follows:—

Crops.

Country.	1887.	1888.	1889.
	Tons.	Tons.	Tons.
Europe	250,036	175,141	172,597
Australia	17,269	26,175	34,468
China	72,848	85,148	62,688
America	5,891	39,208	46,301
Sundries	11,073	12,779	13,824
Total	357,117	338,451	329,878

Of the 1890 crop the following quantities had been exported on December 31 last:—

	Tons.
To Europe	130,219
,, Australia	19,417
,, China	42,187
,, America	65,769
,, Other Countries	15,658
Total	273,250

CANADA.

New Sugar Tariff.

The abolition of duties on sugars under No. 14 Dutch Standard, by the United States, has been almost as a matter of necessity followed by a similar measure in Canada. The new tariff is as given below, and is accompanied by the grant, *for one year only* (a singular limitation of the benefit conferred), of a bounty on home-grown beet sugars of $1 on 100lbs. on sugars polarising up to 70°, plus 3½ cents for every degree or fraction of a degree above that limit. The withdrawal of the protection duty has been at once followed by some import of German sugar.

Sugar below 14 Dutch Standard imported direct from producing country, or grown in India, and transhipped *via* Hong Kong	Duty free.
Sugar below 14 Dutch Standard not imported direct....	5 per cent. *ad valorem.*
Sugar above No. 14	$\frac{8}{10}$ cents* per lb.
Glucose or grape sugar, glucose syrup and corn syrup..	$1\frac{1}{2}$ cent per lb.
Molasses between 40° and 56° polariscopic strength	$1\frac{1}{2}$ cent per gallon.
When testing less than 40° $1\frac{1}{2}$ cents per gallon, and one-fourth of one cent. per gallon, for each degree or fraction under 40°	$1\frac{1}{2}$ cent per gal. and $\frac{1}{4}$ cent per deg.

NOTICES OF BOOKS.

Der Dampf in der Zuckerfabrik (Steam as applied in the Sugar Factory). Edited by Dr. K. Stammer, with the assistance of specialists. Magdeburg: A. Rathke, 1891; price 20 marks.

Dr. Stammer is so well known as an authority on technical matters connected with the sugar manufacture, that we do not like to omit a notice of any work which either proceeds direct from his pen, or bears the imprimatur of his name. In view of the fact that an equally high authority on such matters has published (in the *Deutsche Zuckerindustrie*) a short review of this work we think the best service we can render in this case is that of giving a translation of Dr. Edmund O. von Lippmann's remarks, which are distinguished by his usual ability and acumen. Dr. Lippmann writes:—

As the compiler very rightly points out in his preface, there has been up to now a want of practical, complete and concise directions, specially adapted for sugar manufacturers, with regard to the generation and application of steam, and, as a consequence, the knowledge and opinions, not only of beginners, but also of those more experienced on such questions, are frequently very imperfect and defective, sometimes quite inadequate and preposterous. We, therefore, hail with satisfaction the fact that Dr. Stammer, in conjunction with experienced specialists, such as Professor Brauer, W. Greiner, H. Jelinek, has undertaken the publication of a work which will remedy this defective state of things, inasmuch as the nature and

* About 3s. 8d. per cwt. This is to protect the refiners, whose position is much injured by the changes in the tariff.

properties of various fuels, the generation of steam, its application in driving machinery, and in the concentration of juices, and the use of steam as the general motive power of the factory are exhaustively discussed and thoroughly described, with the help of a long series of excellent drawings and illustrations.

The first book treats of heat and steam, fuels both solid and liquid, and the examination of the smoke-gases, and discusses the properties of steam and its relation to coloric. In the second book there is an exposition of various systems of heating (grate and gas firing, creation of draught, heating tubes, products of heat) of steam boilers (their setting-up, kinds and shapes, fitting-up and management, corrosion), and the purification of the feed-water. The third book treats of steam engines (details, general arrangement, various systems, tension and water supply, steam supply and indicator), and also of evaporating apparatus, and the vacuum-pan (construction, efficiency, calculations for heating surface and heating steam, multiple effects, steam-pumps, condensation, air-pumps, combination systems). In the fourth book examples relating to every use of steam are given, from practical experience, the main purpose being to show how similar questions may be resolved in particular cases, and what results have followed such solutions.

From this rapid summary of the contents, it will at once be seen that Dr. Stammer's latest work covers such a wide extent of varying ground, that an exhaustive treatment of each subject is in the nature of things excluded, all the more so as the prevailing opinions with regard to many of the points treated on are still very divergent, and a book intended for instruction cannot and must not enter into disputes.

The number of the collaborateurs, their varying opinions, and also the necessity for conciseness, must, as the compiler himself points out in the preface, serve as apology for many inequalities in the work, and a want of unity in description and style, which certainly must strike everyone who goes through the work at one sitting. Certainly some compensation for this is supplied by the fact that the associated authors are the most celebrated specialists in the particular matters on which they treat, and hence speak on these points with an amount of insight and experience, such as can never be at the command of any one who obtains his knowledge at second hand. Anything like directly opposing statements or contradictions on the

part of the individual writers are not anywhere very evidently manifest, but on page 320 of the first part, the value of good steam engines in the manufacture of sugar is spoken of somewhat curiously, and in a manner which (in spite of the disclaimer which is entered) might easily create a belief that everything in this respect might go on without any bad results, in the old style, whilst on pp. 84, 137, 159, and 188 of Part 2, we are very clearly instructed respecting better methods.

The book is excellently got up by the publisher; the plain and clear illustrations, the larger of which are inserted in a folded form, deserve special praise. This circumstance also will undoubtedly contribute to obtain well-merited circulation for a work, which none will lay down without having derived great instruction and obtained much and various knowledge, and which further calls for special thanks from the fact that it is adapted and intended to put a final end to any half-knowledge in one of the most important branches of our industry.

Correspondence.

To the Editor of "The Sugar Cane."

Every industry has its advantages and its disadvantages. That of the farmer is subjected probably to greater vicissitudes than any other industry. It is no matter where his farm may be situated, whether in a temperate or a tropical zone, he is met at times with genial or ungenial seasons. A heavy downpour of rain, or an extended season of drought disappoints him of his expected bountiful harvest. The day has in great measure gone by when such calamities were considered as judgments sent for the punishment of sin. "He maketh the sun to shine upon the just and the unjust" should have precluded such erroneous teaching. He, the Ruler of this grand universe in which we live, doeth all things well. What we deem calamities are but blessings in disguise: "I will not again curse the ground any more for man's sake. While the earth remaineth, seed time and harvest, and cold and heat, and summer and winter, and day and night, shall not cease;" *Genesis* viii., 21 and 22. If the farm—say a cane sugar estate—is the one cultivated, then the rain and the drought are intensified by climatic conditions. The Island of Barbados has lately experienced the evil effects of such a long continued drought. It is a dangerous thing to prophesy, but nevertheless I venture to prophesy, that with normal genial weather the

next crop will be largely benefited by the drought, for has not a continued long spell of dry weather being aptly called by some one, "God's plough." The earth is covered, owing to the heat, with wide and deep fissures. These openings allow the atmosphere, charged with ammonia, to enter and fertilize the ground. Hence the wisdom of His work who worketh for all. I venture to predict that if the average product of six years of normal weather was compared with the average product of six years of abnormal weather, where the drought occurred in the third or fourth year the latter average would give the larger result. These recurring dry seasons warn us to supplement our cane crop with some other quick growing crop. I suggested many years ago, through the *Barbados Planters' Journal*, the planting of tobacco. This plant, I understand, comes to maturity in five months. It could be planted as soon as the cane crop was reaped, and could be gathered in before the next cane crop was planted. The objection raised against it was that tobacco greatly exhausted the soil; but surely the value of the crop would, after paying for the manure to replace the exhaustion, leave a handsome sum to the credit of the estate. The drought also points out the advantage of applying artificial composts at two or more different times. I ventured, through the same periodical, to suggest that the application of these fertilizers should be made at twice, pointing out that a man would be the healthier by eating his meals on two successive days than by gorging himself in one. If a drought came, the second application might be omitted, and thus the cost of it saved.

Yours, &c.,

W. H. Jones.

2, Vermont Road, Upper Norwood,
July 24th, 1891.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; 63, Long Row, Nottingham; and 323, High Holborn, London.

ENGLISH.

APPLICATIONS.

10313. William Brantingham Giles and Charles Esau Eastrick, Leyton. *Improvements for the manufacture of sugars, glucoses, and other saccharine solutions.* 17th June, 1891.

10314. Bonifacio Medina Santurio, London. *Improvements in filters.* 17th June, 1891.

10414. Walter Bergius, Glasgow. (Communicated by Carl Liesenberg, Germany.) *An improved composition for and process of clarifying liquids.* 19th June, 1891.

10578. William Richmond, Glasgow. *An improved machine for cutting sugar, dough, and like substances into strips or drops.* 22nd June, 1891.

11152. Joshua Clay Ruby, London. *Improvements in machines for moulding confections, etc.* 30th June, 1891.

11224. Charles George Purdy, London. *An improved filter.* July 1st, 1891.

11418. William Colin Morison, Great Yarmouth. *Crusher and pulveriser.* 4th July, 1891.

ABRIDGMENT.

12272. Leopold May, of Ungarisch-Ostra, Moravia. *Apparatus for moulding sugar to the form of sticks or bars suitable for cutting into cubes.* August 6th, 1890. A case is provided containing a series of superposed plates, each plate having a number of slots right across it. The distance from plate to plate and from slot to slot is equal. Through the slots a second series of plates is passed, thus dividing the space into rectangular compartments in which the sugar is moulded. The second series of plates may be withdrawn to allow the sugar to be removed.

AMERICAN.

ABRIDGMENT.

450262. Louis U. Pangey, of Paris, France. *Apparatus for the manufacture of sugar.* May 12th, 1891. This comprises apparatus for carrying out the process described in patent specification No. 278640. The cooked sugar mass is placed between a pair of endless belts made of skin, steel, or copper, and is thus formed into a thin slab. The belts and the enclosed slab are moved along, and at different points of their travel the latter is treated with clearing liquor, and hot or cold air, &c., applied through perforations in the former for the purpose of refining. The slab of refined sugar may readily be broken into cubes if desired.

453735. Leon Boyer, of New Orleans, Louisiana, Assignor to Ernest F. Herring, of same place. *Apparatus for the treatment of cane juice by filtration.* June 9th, 1891. The filter consists of a strainer

box composed of a series of strainer drawers arranged in sets one below the other, the drawers in each set being of similarly sized mesh, but each mesh having finer mesh than the one before it. Any drain may be removed for cleaning while the others of its set are in action.

451751. Hugh Burgess, of Royer's Ford, Penn. *Vacuum evaporating apparatus.* May 5th, 1891. This is of the "intransit" class. The main improvement seems to be the provision of a superheating coil above the surface of the liquor in each pan for the purpose of assisting to heat the same, and for breaking up the foam.

452063. Louis E. A. Pranfey, of Paris, France. *Manufacture of raw sugar.* May 12th, 1891. The hot raw sugar is placed between a pair of travelling aprons, and, when solidified, the slab thus formed is treated with refining fluids, and finally dried by hot or cold air under pressure. All the operations are continuous.

454056. Thomas Long, of Boston, Mass. *Centrifugal machine.* June 16th, 1891. This invention relates to the providing of suction and forcing vanes upon a part of the machine whereby air pressure and exhaust are caused to co-operate with the centrifugal force.

454072. Philip M. Sharples, of West Chester, Penn. *Method of balancing centrifugal vessels.* June 16th, 1891. Several diagrams and theoretical problems are given. The method of balancing seems to consist in adding weights to such points of the revolving part that the theoretical actual axes of rotation shall agree in both vertical and horizontal action.

455295. James Duncan, of Selby, England. *Method of treating molasses to improve its flavour.* June 30th, 1891. The solution is diluted to 10° Baume, and sulphuric acid is added to decompose the alkaline salts and the volatile impurities, or resultants may be removed by boiling and blowing up with carbon di-oxide or other inert or beneficial gas.

IMPORTS AND EXPORTS (UNITED KINGDOM) OF RAW AND REFINED SUGARS.

January 1st to June 30th.

Board of Trade Returns.

IMPORTS.

Raw Sugars.	Quantities.		Value.	
	1890.	1891.	1890.	1891.
	Cwts.	Cwts.	£	£
Germany	3,615,556	3,242,672	2,135,633	2,028,212
Holland	236,448	254,176	131,563	154,942
Belgium	458,796	513,092	242,206	305,274
France	817,692	889,224	503,840	592,430
British West Indies & Guiana	767,898	694,885	582,329	551,449
British East Indies	267,322	418,788	131,924	223,442
China and Hong Kong	....	....	....	....
Mauritius	78,166	125,189	49,012	78,328
Spanish West India Islands	....	19,935	....	15,699
Brazil	221,851	315,892	132,894	189,166
Java	738,392	1,125,652	531,778	787,795
Philippine Islands	126,964	482,936	68,366	258,622
Peru	370,285	231,354	247,144	160,802
Other Countries	167,729	283,249	117,826	189,844
Total of Raw Sugars	7,867,099	8,597,044	4,874,515	5,536,005
Molasses	321,942	245,897	106,020	76,311
Total Sugar and Molasses	....	....	9,113,766	10,220,970
Refined Sugars.				
Germany	2,612,747	3,216,125	2,116,641	2,617,889
Holland	916,610	789,266	761,841	667,624
Belgium	80,316	92,287	72,739	81,038
France	1,397,123	951,855	1,133,071	788,079
United States	56,240	525,250	47,919	441,342
Other Countries	1,268	15,636	1,020	12,682
Total of Refined	5,064,304	5,590,419	4,133,231	4,608,654

EXPORTS.—Refined Sugars.

	Cwts.	Cwts.	£	£
Sweden and Norway	26,008	41,061	18,645	31,322
Denmark	66,170	71,266	40,748	44,975
Holland	44,938	43,713	31,713	31,531
Belgium	13,691	9,529	9,522	8,193
France	4,255	230	2,754	176
Portugal, Azores, & Madeira	50,165	36,098	33,144	25,009
Italy	46,559	21,283	31,352	15,181
Other Countries	119,237	149,991	89,814	111,139
Total of Exports	371,223	375,545	257,692	267,526

IMPORTS OF FOREIGN REFINED SUGAR.

The following figures give the imports of foreign refined sugar for the month of June, 1891, compared with the corresponding month of the two preceding years, and the average monthly imports for the year compared with those of 1888, 1889, and 1890, distinguishing the quantities of "Lumps and Loaves" from "other sorts," and giving the separate imports from each country:—

Countries from which Sugar has been imported.	"Lumps and Loaves."							"Other Sorts." Including Crushed Loaf, Granulated, Crystallized, &c.							Total.						
	Monthly Average.				June	June	June	Monthly Average.				June	June	June	Monthly Average.				June.	June.	June.
	1888	1889	1890	1891	1889	1890	1891	1888	1889	1890	1891	1889	1890	1891	1888	1889	1890	1891	1889	1890	1891
	Tons.	Tons.	Tons.	Tons.	Tons	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France	1686	1888	3398	1909	2382	3245	2581	4855	3398	8245	6023	5003	8665	8944	6541	5286	11643	7932	7385	11910	11525
Holland	3267	3005	3137	3061	2230	3078	3857	2675	3074	4501	3350	3307	6112	4866	5942	6079	7638	6411	5537	9190	8723
Germany & Austria	1510	2964	2872	2934	2620	2986	4305	11729	17245	18901	23865	12076	21273	26929	13239	20209	21773	26799	14696	24259	31234
Belgium	622	995	425	482	1088	305	246	227	267	244	287	177	400	226	849	1262	669	769	1265	705	472
United States	8	..	38	170	..	..	89	157	98	431	4207	13	1746	1116	165	98	469	4377	13	1746	1205
Russia	..	..	..	..	249	..	..	1959	4275	..	127	1627	..	200	1959	4275	..	127	1876	..	200
Other Countries	1	14	..	..	294	..	..	2	10	10	4	390	27	1	3	24	10	4	684	27	1
Total	7094	8866	9870	8556	8863	9614	11078	21604	28367	32332	37863	22593	38223	42282	28698	37233	42202	46419	31456	47837	53360

SUGAR STATISTICS—GREAT BRITAIN.

FOR THE FOUR PRINCIPAL PORTS.

To July 18th, 1890 and 1891.

In Thousands of Tons, to the nearest Thousand.

	Stocks. 1891.	Stocks. 1890.	Deliveries. 1891.	Deliveries. 1890.	Imports. 1891.	Imports. 1890.
London	42	33	162½	149½	179½	132½
Liverpool ..	43	63	162	156	150½	133½
Clyde	20	37	109½	124½	103½	122½
Bristol	3	2	37	39½	37½	38½
Total ..	108	135	471	469½	471	427

The above figures do not represent accurately, or to the full extent, the position and movements of sugar in the United Kingdom, as Hull, Leith, &c., are not included, there being no published returns for these ports.

SUGAR STATISTICS—UNITED STATES.

(From Willett & Gray's Report.)

For the four principal Ports. In Thousands of Tons, to the nearest Thousand. For June, 1891 and 1890.

	Stocks. July 1st. 1891.	Stocks. July 1st. 1890.	Deliveries. In June. 1891.	Deliveries. In June. 1890.	Imports. In June. 1891.	Imports. In June. 1890.
New York	46½	32½	66	57	72	61½
Boston	8	4½	24½	18	26½	19½
Philadelphia....	7½	4	67½	29	67½	31
Baltimore	2	..	3½	..	3½	..
Total	64	41	161½	104	169½	112
Total for the year			840	658	877	688

NEW YORK PRICES FOR SUGAR.

From Willett & Gray's Report, July 16th, 1891.

Fair Refining.	96o/o Centfs.	Granulated.	Stand. A.	Stock in Four Ports.
July 16, 1891.—3c.*	3 7-16c.*	†4 7-16c.	†4 5-16c.	Jan. 1, 1891— 27,756 tons.
July 17, 1890.—4 13-16c.	5 7-16c.	6¼c.	6c.	Jan. 1, 1890— 11,169 tons.
July 18, 1889.—7⅛c.	8⅛c.	9¼c.	9c.	Jan. 1, 1889— 32,254 tons.
July 19, 1888.—5¼c.	6⅛c.	7¾-13-16c.	7½-⅝c.	Jan. 1, 1888— 47,798 tons.
July 21, 1887.—4½c.	5¼c.	5 15-16c.	5½c.	Jan. 1, 1887—102,279 tons.
July 22, 1886.—4 13-16c.	5 7-16c.	6 3-16c.	5¾c.	Jan. 1, 1886— 57,328 tons.
July 23, 1885.—5⅛c.	6c.	6½c.	6⅛c.	Jan. 1, 1885— 89,186 tons.
July 17, 1884.—5c.	5 15-16c.	6⅞c.	6 7-16c.	Jan. 1, 1884— 60,900 tons.
July 19, 1883.—6 11-16c.	7⅝c.	8 15-16c.	8½c.	Jan. 1, 1883— 50,297 tons.
July 20, 1882.—7¼c.	8 1-16c.	9 ⅜c.	8⅞c.	Jan. 1, 1882— 43,927 tons.

* Net Cash.

Stocks of Sugar in the Chief Markets of Europe on the 30th June, 1891, for Three Years, in thousands of tons, to the nearest thousand.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal entrepôts	Total 1891.	Total 1890.	Total 1889.
119	154	190	140	19	17	639	586	419

Twelve Months' Consumption of Sugar in Europe for Three Years, ending 30th June, in thousands of tons, to the nearest thousand.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal entrepôts	Total 1890-91.	Total 1889-90.	Total 1888-89.
1384	536	494	299	61	387	3161	2992	2836

Estimated Crop of Beet Root Sugar on the Continent of Europe for the present Campaign, compared with the actual crop of the three previous Campaigns.

(From Licht's Monthly Circular.)

	1890-91. Tons.	1889-90. Tons.	1888-89. Tons.	1887-88. Tons.
German Empire..	1,335,000 ..	1,264,607 ..	990,604 ..	959,166
France	700,000 ..	753,078 ..	466,767 ..	392,824
Austria-Hungary.	760,000 ..	787,989 ..	523,242 ..	428,616
Russia	530,000 ..	456,711 ..	526,387 ..	441,342
Belgium........	200,000 ..	221,480 ..	145,804 ..	140,742
Holland........	65,000 ..	55,813 ..	46,040 ..	39,280
Other Countries..	80,000 ..	80,000 ..	87,000 ..	79,980
	3,670,000	3,619,678	2,785,844	2,481,950

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

Although the slightly greater activity reported in our last has more than once been manifested during the month now closing, it has at no time been steadily maintained, and prices must be quoted slightly lower for all kinds of cane sugar than on the 30th June. At the same time there is an improving demand, and were it not for the rather large visible supplies, and the uncertainty as regards the Continental beet crop, we should probably have had to report decidedly higher quotations. The excesss of visible supplies over last year at the same period for Europe alone is believed to be about 100,000 tons, and for Europe and the States some 150,000 tons. Stocks in this country are unusually low.

A better business has been done in refined sorts, which are quoted slightly higher than at the end of the preceding month.

The backward state of the beet crop renders matters still very uncertain, and buyers are disinclined to operate. Inland consumers have been buying somewhat freely direct from the Continent. This is a new feature, and it is very doubtful whether the slight advantage thus obtained—the merchants' profit being exceedingly small—will compensate for the risks run and the disputes which are tolerably certain to result from taking up a trade with the customs, and many difficulties of which the grocers are quite unacquainted.

Present quotations for the standard qualities, as under, are :—

Floating.			Last Month.
Porto Rico, fair to good Refining	12/9 to 14/-	against	13/- to 14/-
Cuba Centrifugals, 97°/。 polarization	14/6	,,	14/9
Cuba, fair to good Refining	13/- to 13/6	,,	13/3 to 13/6
Java, No. 14 to 15 D.S.	14/9 to 15/-	,,	15/- to 15/1½
British West India, fair brown	12/3	,,	12/6
Bahia, low to middling brown	10/6 to 11/-	,,	11/- to 11/6
,, Nos. 8 to 9	11/6 to 12/-	,,	12/3 to 12/6
Pernams, regular to superior Americanos..	10/9 to 12/6	,,	11/3 to 13/-
Landed.			
Madras Cane Jaggery..	9/9	,,	9/9
Manila Cebu and Ilo Ilo	9/3	,,	9/3
Paris Loaves, f.o.b...	17/- to 17/4½	,,	17/-
Russian Crystals, No. 3, c.i.f.	15/3	,,	15/1½
Titlers	18/6	,,	18/3
Tate's Cubes..	20/6	,,	20/-
Beet, German and Austrian, 88%, f.o.b. ..	13/7½	,,	13/4½

THE
SUGAR CANE.

No. 266. SEPTEMBER 1, 1891. Vol. XXIII.

All communications to be addressed and all cheques, &c., made payable to "Edward Sutton, Editor of The Sugar Cane, Manchester," which address is sufficient.

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☞ The Editor is not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

☞ Owing to an oversight, the article by Mr. Geo. Stade, in our issue of last month, on "Modern Processes in Cane Sugar Manufacture," was made to appear as if it had been taken from "*The Sugar Industry and the Sugar Trade of the World.*" These words were merely intended as a translation of "*Zuckerhandel und Zuckerindustrie der Welt,*" the title of a work quoted from by Mr. Stade in the concluding paragraph of his paper. This paper, of which we merely gave the translation, was originally written for, and appeared in, the *Deutsche Zuckerindustrie*, a fact which we ought to have mentioned, but which we overlooked owing to the translation being made from a reprinted pamphlet. We beg to apologise to our esteemed contemporary for the oversight.

Sir Henry Blake, at present in this country, has made the following remarks in a letter written to the *Times* to combat the assertions and misstatements which have been made respecting the Jamaica Exhibition.—"The Jamaica Exhibition was promoted and carried out, first, to bring into prominence an island of great historical interest, as beautiful as the imagination can paint it, of boundless fertility, and with an excellent climate. Next, to demonstrate to a people heretofore prone to rely exclusively upon Government for the accomplishment of any important undertaking that, with combination and energy, difficulties disappear, and there is no such word as "impossible," The Exhibition has done all this and more. It has increased the revenue of Jamaica last year by £60,000 ; extended

trade relations; improved local business; stimulated production; cemented all classes by bringing them together to work for one common object; taught self-reliance; advertised the West Indies, and shown to hundreds of foreign visitors that they could live in Jamaica for months without even hearing the name of yellow fever; while the fact that out of the 304,000 people who during the three months of its duration visited the Exhibition there was not a single arrest for drunkenness or disorderly conduct spoke conclusively for the general respectability of the population. To call an Exhibition giving such results a financial failure is simply an abuse of language.

The *Barbados Agricultural Gazette and Planters' Journal*, referring to the disappearance by death of several "Old Planters" and the loss to the community of practical common-sense knowledge, takes occasion to plead eloquently for a proper system of agricultural education, and points out that technical instruction is the order of the day in all progressive countries, and that in order to make headway against the constantly increasing competition it is absolutely necessary that the young planter shall be armed with the knowledge of the day, provided with which he can certainly command that "success which always comes to the true worker, who, thoroughly equipped, applies his force in the right direction." The same journal points out that, strange to say, there is no Agricultural Board in existence in Barbados.

Consul D. Coen, in his report on the trade of the Dominican Republic in 1890, says:—"The sugar industry, notwithstanding its constant struggle against competition, against depression in prices, and atmospherical accidents, such as the last severe drought which has prevailed for more than 16 months, has given a better result than was expected. Thirty thousand tons have been shipped during the year. This result is mostly due to the sugar estates at San Pedro Macoris, which were in a better situation to support the downfall of prices, thanks to the richness of the soil, and to many other favourable conditions which have been wanting in the case of most of the estates established in the surroundings of this city.

The consular report from Nagasaki (Japan) states that the commodity which seems to exhibit the steadiest tendency to rise is sugar, of which some £90,000 worth was imported last year, being a rise of

about double in five years. As usual of late the refined article was in greater demand than the brown sugar, which formerly was the staple. The increased consumption is due entirely to the fall in price, which was lower in 1890 than at any former period in the history of the port. The direct trade in unrefined Formosan sugar has completely died out, and all the supply now comes from the two refineries at Kong Kong.

In our July number we referred to the opening of the new beet-sugar factory at Sapporo, in the district of Hokkaido (Japan), which has a daily capacity of 200 tons. No doubt this will have some influence on the import trade.

A consular report from the northern district of Siam states that coarse sugar is manufactured there both from the palm and from the sugar cane. The former is mostly made in Lampun, and the latter in Chiengmai, two places not far distant from one another. The supply, however, is inadequate, and a good deal of Siamese sugar is brought up from Bangkok, and also a small quantity of white foreign sugar. The Siamese sugar sells at Chiengmai from 4d. to $5\frac{1}{2}$d. per pound, and the foreign white sugar (moist) at from 1s. to 1s. 6d. per pound. If foreign sugar were brought up and sold at a moderate rate, it would probably have a good sale.

As far as we can learn, the "foreign sugar" comes from Hong Kong.

The *Journal des Fabricants de Sucre* has an article on the relative production and export of Germany, Austria and France, for the 1890-91 campaign. Germany has obtained from 10,624,000 tons of beets a yield of 1,320,000 tons of sugar, or $22\frac{1}{2}$ per cent. of the raw material. She has exported 753,676 tons (in raw sugar value) of which over $\frac{2}{7}$ were refined sugar. Austria-Hungary's production was about 770,000 tons, of which 475,000 tons were exported, nearly half of this being refined sugar. The French exports from 1st September, 1890, to 31st July, 1891, amounted to 168,541 tons, which is 27,881 tons less than in the corresponding period of the preceding year. To a large extent, probably, this is owing to the deficiency in last season's crop. A notable feature, however, of the British imports for July is the falling off in German and Austrian sugar and the considerable increase in that coming from France, so that the latter country may still make up some of the lee-way which is indicated in the article of M. Dureau.

The Havana papers contain a statement of the working of "San Joaquin" and "Montana" estates, belonging to Count Ibanez, and "Caracas," belonging to Messrs. Terry Bros., at all of which difusion apparatus was erected by the Compagnie Fives Lille of Paris. On San Joaquin 55,810 tons of cane were worked up, the average yield obtained being 10·9 per cent., the quantity of sugar left in the cane varying between 0·35 and 0·75 per cent. of the weight.

Owing to the want of water, the working at "Caracas" had to be changed in March, recourse being had to the Mills.

The central factory "Constancia" continued crushing up to the 24th July, the operations of the season will result, according to the *Havana Weekly Report*, in a net profit of $54,000. Messrs. Apezteguia Bros. are to be congratulated on such a splendid result. The same journal contains the following on the "molasses process" in use at the factory:—

SOMETHING MORE ABOUT THE MOLASSES PROCESS.

According to a Cienfuegos paper, the difficulty between Messrs. Apezteguia Bros. and the American Sugar Refining Company was caused by the dark yellowish colour of a parcel of 20,000 bags centrifugated sugar, sold by the former to the latter, who refused to accept said sugars, and sent to their agents at this place the circular mentioned and commented upon in one of our previous issues.

"It appears now that Mr. Manoury, the French chemist and inventor of the process, has just improved it in such a manner that there is nothing to be said as far as the quality, colour and test of the sugar manufactured by this process are concerned, and it is generally anticipated that, as the American refiners will no longer have any just reason to reject sugars manufactured with cane juice and molasses mixed together, this process will be adopted next year by the greater part of the Cuban planters, inasmuch as the yield obtained through its application considerably exceeds that afforded by all the other systems known to this day."

The exports of sugar from Cuba, from 1st December, 1890, to June 30th, 1891, amounted to 493,967 tons against 380,642 tons for the corresponding period last year. Nearly 95 per cent. went to America, the remainder to Spain, none to this country.

A central factory having been proposed, by a firm of machinery manufacturers, to be erected in Antigua, a Committee was appointed

early this year to consider the practical question of possible extra profit by the adoption of the arrangement. Their report seems to indicate a probability that the scheme will be carried out.

A letter from Mr. W. H. Jones in our present issue, alludes to the uses to which sugar and molasses can be put. As regards the latter, it is proposed to use them for adding to cattle food, and it is evident that something must be done, perhaps in the way of distillation, though it is stated that Louisiana alone will next year produce more than five times as much as all the American distilleries are now working up.

Messrs. Mc.Call Bros. are adopting electric lighting for their large factory at Evan Hall (Louisiana), both inside and out. Other factories in the district are doing the same.

Frederick C. Havemeyer, the distinguished founder of the largest sugar refinery in the world, died in New York province, July 21st. in his 85th year. The *American Grocer* says of the Havemeyer family:—"They have always been progressive, quick to adopt all new methods and improvements, never hesitating as did their competitors, the Stuarts, to abandon an old refinery with obsolete machinery, thereby entailing an enormous loss, in order to adopt the latest and most approved appliances for refining sugar. The firm has steadily sought to provide the masses a high grade of sugar at low cost, and are entitled to be considered as the leaders in all that pertains to the development of one of the most important industries in this country."

Under the name of the Calcasieu Sugar Company, Limited, a company is being formed for building and working a factory at or near Lake Charles, Louisiana. The capital is to be $500,000, and the erection of the factory has about commenced.

The ratification of the reciprocity treaty between the United States and Spain was officially announced on the 31st July.

ERRATUM.

By a slip of the pen we stated, on page 437 of our August issue, the limit of colour for free sugar in the United States as 14, instead of 16, D.S.

CALIFORNIA.

Extract from British Consular Report for the District of San Francisco for 1890.

The principal sugar imports at this port came from the Hawaiian Islands; the quantity having being 112,952 tons, whilst 7,605 tons came from Manila.

From Los Angeles Mr. Vice-Consul Mortimer reports as follows respecting beet-sugar:—

The cultivation of beets for the manufacture of sugar has been commenced in this district in the past two months. The Chino Valley Beet Sugar Company is constructing a factory on the Chino Ranch in San Bernardino county, 35 miles east of Los Angeles, at a cost of £100,000. This company owns two factories in the State of Nebraska, and is now about to operate in California, because it is thought that this climate will admit of operations being carried on for about seven months in the year, whereas in Nebraska the season lasts only three months. The factory will have a capacity of 500 tons of beet per day, and will, it is stated, be the largest in the United States. It is proposed to keep it running by planting crops once a month, from February 1 to July 1. Mr. Gird, the owner of the Chino Ranch, has agreed to plant 5,000 acres in beets, and offers for sale or rent 23,000 acres in small tracts to farmers who will cultivate in beets. This is the first attempt at sugar beet culture in Southern California, and from the extensive preparations being made, the parties interested must be very confident of success. The United States Government has issued a pamphlet of about 250 pages on the sugar beet industry, entitled "Bulletin No. 27 of Chemistry Division of Department of Agriculture." From this publication I make the following extract:—"The area of soil suitable for beet cultivation in the county of Los Angeles is 1,480 square miles, and in the county of San Bernardino 465 square miles. . . . From the date of yield of beets per acre, and sugar per ton of beets (elsewhere than in Southern California), the average may be put at 15 tons and 9 per cent. respectively, or 2,700lbs. of sugar per acre." This is 3 tons and 3 per cent. respectively below the average results obtained by Mr. James Duncan, in Suffolk." On the other hand, the experiments made in the Chino

Ranch in the past two years indicate that the results obtained there are far above the average in the most favoured beet districts of Europe or America. Mr. Gird writes me as follows :—"The highest percentage of sugar obtained in the beets grown for experimental purposes was 24 per cent. of the weight of the beet." The factory will be supplied chiefly by tenant farmers on Mr. Gird's estate. In the contracts with these farmers the prices to be paid for the beets are specified as follows:——"14s. per ton for beets containing an average of at least 12 per cent. of sugar to the weight of the beet, with a purity co-efficient of 80 per cent., and an additional 1s. per ton for each and every per cent. of sugar contained above 12 per cent., as determined by daily lists to be made in Mr. Gird's laboratory." On this scale of prices it is thought that farmers will receive from 16s. to £1 per ton, and at a maximum of 15 tons per acre the gross yield would be £12 to £15. Mr. Gird writes me that an industrious farmer can cultivate about 20 acres in beets, and on the terms on which he is prepared to rent a minimum net profit of £6 per acre can be realised. It is stated that beets can be raised between the rows of fruit trees in young orchards, and that in this way farmers can realise a profit while their fruit trees are maturing. I always advise English farmers coming here to settle to rent for a year or two before purchasing land, and I now draw special attention to the beet sugar industry, because I think it offers a fair chance to strangers settling here to make a profit as tenant farmers, with the minimum of risk. In the recent changes in the United States customs tariff, sugar under No. 16 Dutch Standard was conditionally placed on the free list, and a bounty of $\frac{3}{4}$d. to 1d. per lb. offered for all sugar produced in the United States. It appears from the Government publication, to which I have referred, that in California only has permanent success been obtained in the cultivation of beets for the production of sugar.

CANADA.

NEW SUGAR TARIFF.

The abstract given in our last issue of the provisions of the new duties in Canada was not quite clear, we therefore give the full text as officially published, and take this opportunity of correcting the statement, then made, that the refiners were injuriously affected by the change.

1. All molasses and syrups N. O. P., including all tank bottoms and tank washings, all cane juice and concentrated cane juice and all beet root juice, and concentrated beet root juice, when imported direct without transhipment from the country of growth and production.

(a.) Testing by polariscope 40 degrees or over and not over 56 degrees, a specific duty of 1½c. per gallon.

(b.) When testing less than 40 degrees a specific duty of 1½ cents per gallon, and in addition ¼ cent per gallon for each degree or fraction of a degree less than 40.

(c.) And in addition to the foregoing rates a further specific duty of 2½ cents per gallon when not imported direct without transhipment.

2. All cane sugars and beetroot sugars not above 14 Dutch standard; all sugar sweepings, all sugar drainings, all melado and concentrated melado, all molasses and concentrated molasses, N. O. P., all cane juice, beetroot juice, tank bottoms and concrete, *when not imported direct* without transhipment, 5 per cent. *ad valorem*, provided, however, that in the case of cane sugar produced in the East Indies and imported *via* Hong Kong, such rate of 5 per cent. *ad valorem* shall not be collected if transhipped at Hong Kong.

3. All sugar above 14 Dutch standard, and refined sugars of all kinds, grades and standards, and all sugar syrups derived from refined sugars, a specific duty of 8·10 per cent. per lb.

4. Glucose, or grape sugar glucose, or corn syrup, a specific duty of 1½ cent per lb.

Resolved—That it is expedient to provide that there be added to Schedule C to the Act, chapter 33, revised statutes as being *exempt from customs duties*, the following, viz.:—All cane sugars and beetroot sugars not above No. 14 Dutch standard in colour, all sugar sweepings, all sugar drainings, or the pumpings drained in transit, all melado and concentrated melado, all molasses and concentrated molasses, N. O. P., all cane juice and concentrated cane juice, &c., *when imported direct* without transhipment from the country of growth and production.

Resolved—That it is expedient to provide that the foregoing resolutions and the alterations thereby made in the duties of customs on the articles therein mentioned shall take effect on and after the 24th day of June, 1891, provided, however, that nothing herein shall be construed as exempting any sugars now held to be in bond for refining purposes in any bonded premises connected with or occupied in whole

or in part by any sugar refinery which may be found on examination of the stock in such premises to have been removed therefrom without payment of the duty properly payable thereon under item 419 in Schedule A to the Act, chapter 33, Revised Statutes, which shall continue in force as regards such sugar until proper entry thereof and payment of duty thereon has been made.

Resolved—That it is expedient to amend the Act, chapter 32, revised statutes, entitled an Act respecting the Customs, of repealing section 944 respecting the refining in bond of sugar molasses or other material from which refined sugar can be produced.

Resolved—That it is expedient to provide that under such regulations and restrictions as may be by the Minister of Customs deemed necessary, there may be paid to the producers of any raw beet sugar produced in Canada wholly from beets grown therein between July 1st, 1891, and July 1st, 1892, a bounty equal to $1 per 100lbs., and in addition 3 1-3 cents per 100lbs., for each degree or fraction of degree over 70 degrees.

FRENCH SUGAR LEGISLATION.

The following is a translation of the text of the new sugar law passed by the Chamber of Deputies and the Senate, and promulgated by the President of the Republic on the 29th June of this year.

Article 1. Commencing from the 1st September next, and for the following campaigns, the legal yield per 100 kilos. of beets put into work in the home sugar factories is fixed at 7·750 kilogrammes.

Where the actual yield of any factory does not exceed 10·500 kilos. of refined sugar per 100 kilos. of beets, the whole of the excess is admitted to the benefit of the reduced duty enacted by the first paragraph of Article 1 of the law of August 5th, 1890.*

The half only of any excess obtained above 10·500 kilos. of sugar per 100 kilos. of beets is subject to this reduced duty; duty being levied on the other half at the full rate of 60 fr. per 100 kilos.

Those manufacturers who, previous to the 1st November of each year, shall make declaration at the Bureau de la Régie, that they renounce any claim to the benefit of the premium on the excess over legal yield, shall be allowed a drawback of 15 per 100 on the total amount of their manufacture.

* See *Sugar Cane* for October, 1890, pp. 518 and 519.

Sugars on which this drawback is allowed are subject to a duty equal to that applicable to the sugars representing the excess yields.

The *prise-en-charge* (legal yield) fixed by the first paragraph of the present article applies definitely under one or the other of the two modes of levying duty above-defined, whatever may be the eventual excess or deficit.

Article 2. The drawback on manufacture, allowed to manufacturers who are also distillers, by Article 6 of the law of August 5th, 1890, is reduced to 15 per 100, commencing from the campaign of 1891-92.

Article 3. Molasses delivered from one factory to another or to a *sucraterie* under fiscal supervision are credited to the manufacturing account at the rate of 30 kilos. of refined sugar per 100 kilos. of molasses. They are taken into account at the factory where delivered for the quantity of refined sugar with which the account of the sender has been credited. Only molasses already worked and containing not more than 50 per 100 of absolute sugar are subject to these conditions.

Article 4. No modification with regard to the fixing of the *prise-en-charge* or the drawback, which may be the object of further legislation, shall be applicable before the expiration of one year from the promulgation of the new law.

Temporary Provision.

Article 5. For the campaign 1890-91, a drawback of 15 per 100 on the total quantity manufactured shall be allowed to those sugar manufacturers who, by declaration made at the Bureau de la Régie within five days at the latest from the promulgation of the present law, shall renounce any claim to the benefit of the premium on sugar obtained above the legal *prise-en-charge*.

The last paragraph but one of Article 1, cited above, is applicable to the sugars representing this drawback.

LOUISIANA'S CAPACITY FOR SUGAR PRODUCTION.

Many persons familiar with the sugar industry of Louisiana have hardly considered the immense acreage that could be added to our cane fields at once when the machinery is built and ready to handle the cane. From New Orleans to Baton Rouge, on either side of the river, there does not seem to be over one-third of the open fields now in cane culture. There seems to be a larger acreage of rice than of sugar cane, and many fields lie entirely idle.

If this be the case on the Mississippi river from New Orleans to Baton Rouge, it seems likely to be the case all over the sugar parishes.

If we assume then that Louisiana produced over 200,000 tons of sugar in 1890, and this from one-third of its old cane fields, leaving two-thirds of the cane fields of *ante bellum* days uncultivated or now cultivated in rice, we see at once that the cane fields of 1860 cultivated in cane as in 1890 and the cane manufactured into sugar as in 1890, would give us right now a production of 600,000 tons of sugar. We are now on the high road to reach these figures, and they will come through the adoption of the central factory idea.

Sugar cane is an incomparably more certain crop than rice, and can be made fully as profitable wherever there are buyers for sugar cane, and buyers are developing everywhere.

It is not necessary that a central factory should be built costing half a million dollars to ensure a market for sugar cane. Let every planter that has a good sugar house buy all the small patches of cane near him, paying for it all he can possibly afford to, and thus encourage such cane production. In a general way any planter can afford to pay for sugar cane delivered to him, one-half the produce of the cane packed ready for market, or one-half its net proceeds, if money price be paid.

If this matter were carefully considered, and if our present sugar planters would take the trouble and make the effort, we could double our area in sugar cane within five years.

It has been the reproach of Louisiana that her sugar industry was not progressive; that it was not worth legislating for. The authors of these remarks had no adequate idea of what Louisiana had done during the last twenty years, how wonderfully she has progressed, how she has thrived in the face of disaster, and has now become the third largest producer of sugar in the world, from tropical cane.

The long drought this spring and early summer threatened disaster to Louisiana sugar interests, but the magnificent weather we are now having from an agricultural point of view, *hot and humid*, with daily showers, is forcing the crop right along, and its condition seems to be unquestionably better than an average. Should those showers continue through August, 1891 will go in the calendar of red-letter years, like 1890, 1887, 1882, and 1878.

Our present careful cane culture and sugar manufacture are showing what can be done and are making the business a more certain

one. The vicissitudes of the industry are being reduced and increased certainty reached.

These facts should lead to the rapid expansion of our acreage in cane culture, and as we are now upon the eve of fall ploughing and seed cane allotment and saving for the crop of 1892, every one interested should endeavour to promote the common good by lending all possible aid to the enlargement of the area in sugar cane. Economic sugar production must come from large quantities handled with skill and economy.

Our 700 sugar houses hope to make 275,000 short tons of sugar in 1891. They may make 225,000 short tons or 320 average per sugar house. Germany's 400 sugar houses make over 1,200,000 long tons, or over 3,000 long tons per sugar house. If we require 10 sugar houses, 10 engines, 10 sugar boilers, 10 sugar chemists, &c., to do what Germany does with one of each, can we hope to compete?

The suggestion is obvious. We must enlarge our cane acreage and enlarge our present factories, and from the magnitude of the enlarged business reach a degree of economy in production that can be reached in no other way.—*Louisiana Planter.*

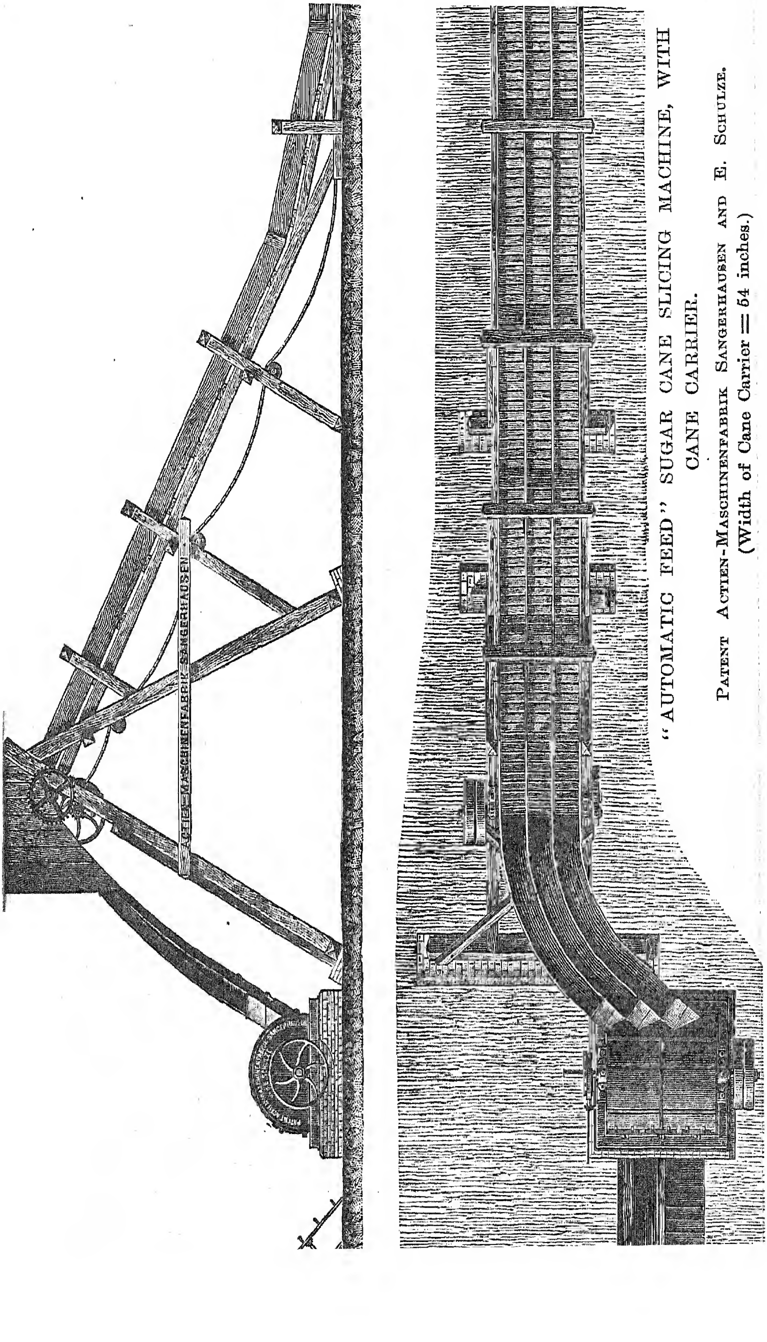
NEW AUTOMATIC-FEED CANE-SLICING MACHINE.

Under the above heading we gave, in January last, a description of this machine, invented and manufactured by the Sangerhäuser Aktien-Maschinenfabrik und Eisengiesserei (formerly Hornung and Rabe) and E. Schulze, of Sangerhausen, Germany.

We are now able to give illustrations of this patent. The larger of these shows the machine in connection with an ordinary cane-carrier, the latter being divided by means of upright boards into three compartments through its entire length, each compartment supplying one of the three feed-hoppers of the machine with cane.

The smaller illustration shows the machine proper, and is taken from a photograph of one built for the Honolulu Iron Works Co., Hawaiian islands. This machine has three conical cutting drums, each fitted with twelve knives, and runs at a speed of 210 revolutions per minute, its daily capacity being about 400 tons of cane.

The carrier keeps the feed-hoppers steadily supplied with cane, and runs at a somewhat higher speed than an ordinary mill carrier. The width of each of the three compartments is 18 inches.

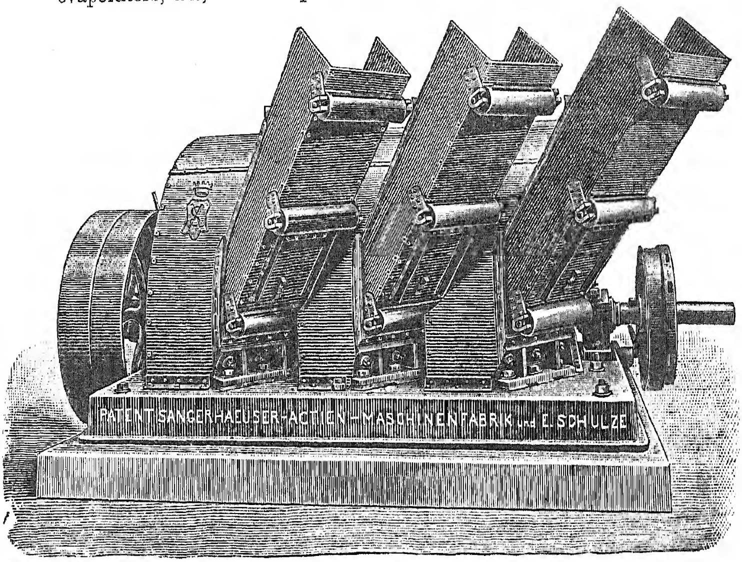


"AUTOMATIC FEED" SUGAR CANE SLICING MACHINE, WITH CANE CARRIER.

Patent Actien-Maschinenfabrik Sangerhausen and E. Schulze.

(Width of Cane Carrier = 54 inches.)

The Sangerhäuser Company is now constructing two of these cane-slicers, one for a new factory near Pernambuco, to work up with diffusion 300 tons of cane per day, the whole plant being supplied by the Company. The other is for a factory in Mauritius, at which they have contracted to erect a Diffusion Battery with quadruple effect, evaporators, &c., to work up 150 tons of cane per day.



DEFECATION BY ELECTROLYSIS.

In March and April of the present year we gave a tolerably full description of the apparatus designed by Messrs. E. Maizrot and J. Sabatés, of Havana, for the defecation of saccharine juices by electricity. Messrs. Whitman & Wilkinson, patent agents, of Washington, U.S.A., have supplied *The Louisiana Planter* with the following synopsis of the specification of the patent taken out for the United States by the inventors. We own to some feeling of curiosity as to this further application of electricity to the manufacture of sugar, and it is principally the desire once more to call attention to this novelty that induces us to reprint below the description in question. There is a vague notion very generally current that electricity can do everything, and certainly its capability of application has not yet been anything like fully tested; the new invention

appears to us to offer certain advantages, but also to be open to some objection from a chemical point of view.

"The apparatus consists essentially of a double fluid electrolytical cell, the two fluids being water and cane juice, running on opposite sides of a porous partition, such as parchmentised paper. The electrodes, one in each partition, are large carbon plates connected to the poles of a dynamo. These cells are arranged as two distinct series of troughs partitioned longtitudinally and connected to each other, with automatic means for adjusting the height of the fluid in, and its flow through each trough. After the juice has flowed through a portion of the series of divided troughs the direction of the electric current is reversed.

"The positive electrode being at first in the cane juice, and the negative electrode in the water, the chemical re-action is as follows:—

"Oxygen is set free at the positive electrode in the juice compartment by the decomposition of the water contained in the said juice, and hydrogen is liberated by the decomposition of the water surrounding the negative electrode, water in its natural state having sufficient electrical conductivity to start the process. The mineral salts contained by the saccharine juice, such as the salts of potassium, sodium, magnesium and calcium, are decomposed by electrolytic action, the acids seeking the positive pole, the bases being transferred through the parchment paper septum to the negative pole, while the protein and peptic substances which existed in the solution remain in solution in the juice until they are transformed by the ozonized oxygen liberated by the decomposition of the water into insoluble fibrine, which is removed by filtration after passing the first series of troughs. During the first step in the process the juice receives all its *electro-chemical* treatment.

"In the second step the passing of the juice through the second series of troughs where the direction of the electric current is reversed, is designed to separate the organic acids from the juice by the *electro-dynamic* operation. The current under these circumstances transfers the acids from the juice in one compartment to the water in the other compartment.

"The juice is discharged from the apparatus in a neutral state and is in suitable condition for evaporation.

"The cost of this electrolytical treatment is not stated, but would mainly depend upon the cost of fuel or water power. Under fixed conditions it might be readily estimated."

THE CHINO VALLEY BEET SUGAR FACTORY.

On page 454 we give the British Consular Report on the sugar trade of San Francisco for 1890, in which mention is made of the new factory being constructed on the Chino Ranch in San Bernardino county, California, 35 miles from Los Angeles. We now append a description of this factory, reprinted from the *Louisiana Planter*. The Maschinenfabrik Grevenbroich, which is executing nearly all the work, has a high reputation in Europe for the excellence of its machinery and sugar plant, based on long experience in this special branch.

"This factory will have the capacity to work 330 tons of beet per day of twenty-four hours, and is so constructed as to be readily enlarged to 550 tons capacity. The beets are brought to the factory in small dump carts of 3 tons capacity each, which are pulled by a traction engine, or are brought by the Chino Valley narrow-gauge railway. Both of the above methods of conveyance discharge into the beet sheds, which are 1,200 tons capacity. From these sheds the beets are floated on a canal directly into the factory and into a sloping spiral elevator. The supply of water for this canal comes from the condenser with a temperature of 40° C., or cold from the artesian wells. This spiral elevator conveys the beets to the washing machines, and it has a diameter of 4 feet, and is 28 feet long. It is ingeniously arranged to avoid the wear on the lower end of the elevator, which has the whole of its own weight and that of the beets and water to carry. The washing machines, aside from washing the beets, secure also the absolute separation of all stones. From this washing machine the beets fall into a sloping, hopper-like open and perforated square spout, which conveys them to the beet elevator while permitting a free discharge of the drip water. The beets fall into the beet accumulator, which has a perforated bottom, and is located on the third floor. The beets are here weighed on an automatic scale with control apparatus, giving an accurate record of all beets worked per day or season. The capacity of the scale is 500 pounds, and the beets cannot pass the discharge gate leading to the slicers below without giving a proper and exact account of the weight on the control apparatus.

"The slicer is provided with 16 right-angle shaped knives, with 22 to 25 V-shaped sub-divisions in each knife, and discharges the beet slices directly on to the belt conveyor which feeds the diffusion

battery. A straight line battery has been adopted as readily allowing an increase of capacity, while recent improvements have reduced the manual labour to that required for the ordinary round battery. There are 12 diffusion cells of 1,050 gallons capacity each, each with a heater having a heating surface of 40 square feet. The cells discharge the beet pulp from their sides at the bottom, and the pulp falls on to a horizontal belt conveyor which conveys to a hopper connected with a sloping bucket elevator which carries it to the pulp presses located on the third floor. The pressed pulp is discharged into the Chino Valley Railway cars on the track outside the factory.

"Returning now to the diffusion battery; the juice from this runs into the measuring tank, which is supplied with control apparatus and electric signal bell, and then passes through two exhaust steam heaters of 400 square feet heating surface each, and is heated there by the vapour of the quadruple effect on its way to the condensers, or by the exhaust steam.

"The juice, heated to about 90° C, runs by gravity to the first carbonation tank, and is treated with milk of lime and carbonic acid, and is then pumped through the first Cizek filter press. This double press, with hydraulic joints, has 320 frames, giving filter cakes of $1\frac{1}{8}$ inches thickness, has 2,000 square feet of filtering surface, and a capacity of 600 gallons of lime refuse. Beneath the presses there is located a trough for measuring the juice and sweet wash water. The juice and the first portion of this sweet water run together to another filter apparatus, subsequently described, and the last portion of the sweet water runs into the lime station, and is used for slaking lime. The lime refuse falls directly from the open frames into small railroad cars, which convey it outside the factory on an elevated trestle work for dumping to the ground. In the meanwhile the juice and sweet water coming through the presses pass through two Danek filters of 300 square feet filtering surface each, and then go through the second carbonation process. This twice saturated juice is pumped to the second double Cizek press of 80 frames, of same size and surface as the first named press.

"The filtered juice and portion of sweet water is now pumped by a separate pump to the filter tower into the sulphur station. The juice, here treated with sulphurous acid gas, passes under small pressure through two Danek filters of 600 square feet of filtering surface, after which it goes to the evaporating apparatus, which consists of four

pans, each with 1800 square feet of heating surface. The thick juice is now treated again with sulphurous acid, and passes through two Danek filters and is taken into one of the two vacuum pans having a capacity of 30,000 pounds of masse cuite.

"Exhaust steam only is used in evaporating, while both exhaust and live steam may be used in the vacuum pans.

"The masse cuite runs into one of the two large mixers and is taken when desired into the conveyor located below each, which has a bottom discharge over each centrifugal, these machines being located on the first floor. The white sugar thus produced is dried in a granulator, and passes through a sieve fastened thereon, and runs into sacks, after which it is ready for consumption.

"In regard to the general arrangement of the machinery, etc., the following may be said:—The beet conveyors, washing machines, elevators, slicing machines and presses are driven by a 50-horse power engine. The centrifugals, mixers, granulator and syrup pumps receive their motive power from an 80-horse power engine, the pumps are so constructed and combined that two air pump cylinders with two double separate working sweet water pumps are driven by one horizontal engine. The carbonic acid pump is of about the same construction and arrangement, and combined with it are two juice pumps and one air compressor. Two Knowles water pumps of 1,000 gallons per minute capacity each, supply water for diffusion, condensation, and washing. The five boilers used are of the Campbell and Zell make, of Baltimore, and of 250-horse power. Lime and carbonic acid are furnished by two lime kilns, having a capacity of 1,100 cubic feet; the dimensions of the building are 282 feet long, 59 feet average width, with a height of 42 feet to the eaves. The tower is 82 feet high and 34 by 59 feet square. All the wall and part of the ceiling are constructed with brick and cement, the columns are of cast iron, with steel beams in the ceilings and floors. The roof is made of heavy wood and iron combination trusses covered with corrugated iron, and all the plans as well as the machines, pipes and other apparatus, excepting mixers and centrifugals, are furnished by the Maschinenfabrik Grevenbroich, successors to Langen and Hundhausen, Grevenbroich, Germany."

At the moment of going to press, we learn that the factory has been working, to complete satisfaction, since the 20th August.

STUDY OF A METHOD FOR THE QUANTITATIVE DETERMINATION OF SUCROSE, INVERT-SUGAR, AND DEXTROSE, OR LEVULOSE.

BY F. G. WIECHMANN, PH.D.

Part II.

For reasons indicated in Part I. of this article,* a careful investigation was made concerning the various conditions which affect the destruction of the levulose on treatment with hydrochloric acid. It soon became patent that in order to gain a clear understanding of the problem, like attention would have to be given to the behaviour of invert-sugar and of dextrose, under similar conditions; in consequence, this investigation was extended considerably beyond the limits originally intended.

The results obtained are recorded in seven "Series of Experiments," which are given below:

For valuable and conscientious work performed in the securing of these data, the writer acknowledges his indebtedness to his assistants, Messrs. Brainerd and Ziebolz.

All determinations refer to 0·25 gramme, dry substance.

Invert-sugar, dextrose, and levulose were each separately studied with reference to variations in:—

a. The time of boiling.

b. The amount of acid.

c. The time of boiling against the amount of acid.

These tests are given in Series 1, 2, and 3.

Series 4 and 5 treat of the behaviour, under like variations of conditions, of mixtures of invert-sugar and dextrose, and of invert-sugar and levulose 94·0 per cent. of the former to 6·0 per cent., respectively, of dextrose and of levulose.

Series 6 exhibits the behaviour of invert-sugar and dextrose, mixed in different proportions, when exposed under the same conditions as to time of boiling and amount of acid present.

Series 7 shows a parallel set of tests, carried out on corresponding mixtures of invert-sugar and levulose.

* See *The School of Mines Quarterly*, Vol. xi., No. 3, 1890.

SERIES I.—INVERT SUGAR.

0·25 gramme of dry substance used in each experiment.

Condition varied: Time of Boiling.		Condition varied; Amount of Acid.		Conditions varied: Time of Boiling and Amount of Acid.	
60 C.C. H Cl (6 x normal strength) were used in each experiment.		Time of Boiling: Four hours in each experiment.			
Time of boiling in hours.	If all levulose, and *only* levulose, were destroyed, there would be reduced of Cu = 0·2355. There *were* reduced of Cu:	Amount of H Cl (6 x normal strength) used.	If all levulose, and *only* levulose, were destroyed, there would be reduced of Cu = 0·2355. There *were* reduced of Cu:	Time of boiling, in hours; am't of H Cl (6 x normal strength) used.	If all levulose, and *only* levulose were destroyed, there would be reduced of Cu = 0·2381. There *were* reduced of Cu:
1	0·2632 0·2675 0·2698 } 0·2668	30 C.C.	0·2564 0·2609 } 0·2587	3 h'rs. 120 C.C.	0·2223 0·2254 } 0·2239
2	0·2546 0·2591 } 0·2568	60 C.C.	0·2350 0·2362 } 0·2356	6 h'rs. 60 C.C.	0·2290 0·2300 } 0·2295
3	0·2490 0·2492 } 0·2491	90 C.C.	0·2147 0·2184 } 0·2166		
4	0·2350 0·2362 } 0·2356				
6	0·2232 0·2267 } 0·2249				

Inspection of Series No. 1, invert-sugar, teaches:—

1. That, working with the prescribed amount of hydrochloric acid, of six times the normal strength, a boiling-time of four hours is necessary to effect complete destruction of the levulose present.

2. That boiling continued beyond this time results in partial destruction of the dextrose.

3. That, the time of boiling being the same, the action which the acid exerts upon the invert-sugar is directly proportional to the amount of acid present; that is to say, insufficient acid will leave some levulose undestroyed; excess of acid will destroy some dextrose in addition to the levulose.

4. That the time of boiling and the amount of acid used are directly interchangeable; that is to say, that practically the same results are obtained by boiling for three hours with 120 c.c. of acid as by boiling six hours with 60 c.c. of acid.

SERIES II.—DEXTROSE.

0·25 gramme dry substance used in each experiment.

Condition Varied: Time of Boiling.		Condition varied: Amount of Acid.		Conditions varied: Time of Boiling and Amount of Acid.	
60 C.C. HCl (6x normal strength) were used in each experiment.		Time of Boiling: Four hours in each experiment.			
Time of Boiling, in hours.	If the dextrose were not attacked by the acid, there would be reduced of Cu = 0·4505. There *were* reduced of Cu:	Amount of HCl (6x normal strength) used.	If the dextrose were not attacked by the acid, there would be reduced of Cu = 0·4505. There *were* reduced of Cu:	Time of Boiling, in hours; am't of HCl (6x normal strength) used.	If the dextrose were not attacked by the acid, there would be reduced of Cu = 0·4570. There *were* reduced of Cu:
1	0·4323 0·4350 } 0·4337	30 C.C.	0·4282 0·4288 } 0·4285	3 h'rs. 120 C.C.	0·2914 0·2973 } 0·2944
2	0·4270 0·4296 } 0·4283	60 C.C.	0·3977 0·3986 } 0·3982	6 hr's. 60 C.C.	0·2901 0·2929 } 0·2915
3	0·4153 0·4173 } 0·4163	90 C.C.	0·3852 0·3861 } 0·3857		
4	0·3977 0·3986 } 0·3984				
6	0·2901 0·2929 } 0·2915				

Inspection of Series No. 2, dextrose, shows:—

1. That dextrose in solution is attacked by hydrochloric acid of six times the normal strength.

2. That, the amount of acid used being constant, the amount of dextrose destroyed depends upon the length of time that the boiling is continued.

3. That the amount of dextrose thus destroyed is not the same for corresponding periods of time, but rapidly increases as the time of boiling is prolonged. Thus, the difference in the amounts of copper reduced, is: Between one and two hours' boiling, 0·0054; between two and three hours' boiling, 0·0120; between three and four hours' boiling, 0·0179; between four and six hours' boiling, 0·1069.

4. That, the time of boiling being the same, the action which the acid exerts upon the dextrose is proportional to the amount of the acid present—the more acid, the more dextrose is destroyed.

5. That the time of boiling, and the amount of acid used are, practically, interchangeable factors.

SERIES III.—LEVULOSE.

0·25 gramme dry substance used in each experiment.

Condition varied: Time of Boiling.		Condition varied: Amount of Acid.		Conditions varied: Time of Boiling and Amount of Acid.	
60 C.C.HCl (6x normal strength) were used in each experiment.		Time of Boiling: Four hours in each experiment.			
Time of Boiling, in hours.	Untreated levulose reduces of Cu = 0·4290. If all levulose were destroyed no Cu would be reduced. There *were* reduced of Cu:	Amount of HCl (6 x normal strength) used.	Untreated levulose reduces of Cu = 0·4290. If all levulose were destroyed no Cu would be reduced. There *were* reduced of Cu:	Time of Boiling, in hours; am't of HCl (6 x normal strength) used.	Untreated levulose reduces of Cu = 0·4228. If all levulose were destroyed no Cu would be reduced. There *were* reduced of Cu:
1	0·2716 0·2746 } 0·2731	30C.C.	0·2620 0·2640 } 0·2630	3 h'rs. 120 C.C.	0·0518 0·0572 } 0·0545
3	0·2082 0·2162 } 0·2122	60C.C.	0·0878 0·0886 } 0·0882	6 h'rs. 60C.C.	0·0468 0·0477 } 0·0473
4	0·0878 0·0886 } 0·0882	90C.C.	0·0370 0·0376 } 0·0373		
6	0·0468 0·0477 } 0·0473				

Series No. 3, levulose, shows:—

1. That, the amount of acid being constant, the amount of levulose destroyed depends upon the length of time that the boiling is carried on.

2. That, the time of boiling being constant, the amount of levulose destroyed is proportional to the amount of acid used.

3. That the time of boiling, and the amount of acid used are, practically, interchangeable factors.

Series No. 4 and No. 5 exhibit the determinations made, respectively on mixtures of invert-sugar (94 per cent.) with dextrose (6 per cent.), and with levulose (6 per cent.).

Both series show:—

1. That, the amount of acid remaining constant, the time of boiling determines the extent to which the sugars are decomposed.

2. That, the time of boiling remaining constant, the extent to which

the decomposition is effected is dependent upon the amount of acid present.

3. That the time of boiling, and the amount of acid used, are, practically, interchangeable factors.

All of these tests, made on *mixtures* of invert-sugar and dextrose, and invert-sugar and levulose, respectively, are simply confirmatory of the results obtained by the experiments made with these substances individually.

SERIES IV.—INVERT-SUGAR AND DEXTROSE.

(940 %.) + (6·0 %.)

0·25 gramme dry substance used in each experiment.

Condition varied: Time of Boiling.		Condition varied: Amount of Acid.		Conditions varied: Time of Boiling and Amount of Acid.	
60 C.C. HCl. (6 x normal strength) were used in each experiment.		Time of Boiling: Four hours in each experiment.			
Time of boiling in hours.	If all levulose, and *only* levulose were destroyed, there would be reduced of Cu = 0·2526. There *were* reduced of Cu:	Amount of H Cl (6 x normal strength) used.	If all levulose, and *only* levulose were destroyed, there would be reduced of Cu = 0·2526. There *were* reduced of Cu:	Time of boiling, in hours: a'mt of HCl (6 x normal strength) used.	If all levulose, and *only* levulose were destroyed, there would be reduced of Cu = 0·2526. There *were* reduced of Cu:
1	0·2848 0·2864 } 0·2856	60 C.C.	0·2397 0·2428 } 0·2413	3 h'rs. 120C.C	0·2289 0·2300 } 0·2295
2	0·2570 0·2600 } 0·2585	120CC.	0·2080 0·2126 } 0·2103	6 h'rs. 60 C.C.	0·2298 0·2316 } 0·2307
3	0·2497 0·2533 } 0·2515				
4	0·2397 0·2428 } 0·2413				
6	0·2235 0·2270 } 0·2253				

In addition to establishing these facts, Series 4 and 5 show—as was to be anticipated—that the length of time during which the boiling must be continued, in order to destroy all of the levulose,

depends upon the amount of levulose present. Thus, in the mixture consisting of invert-sugar 94 per cent., plus dextrose 6 per cent., three hours yield a result most closely approximating the theoretical value; and, in the case of the mixture of invert-sugar 94 per cent. and levulose 6 per cent,, four hours were needed to obtain this approximation.

Series V.—Invert-Sugar and Levulose.

(94·0 %.) + (6·0 %.)

0·25 gramme dry substance used in each experiment.

Condition varied: Time of Boiling.		Condition varied: Amount of Acid.		Conditions varied: Time of Boiling and Amount of Acid.	
60 C.C. H Cl (6 x normal strength) were used in each experiment.		Time of Boiling: Four hours in each experiment.			
Time of boiling in hours.	If all levulose, and *only* levulose, were destroyed, there would be reduced of Cu = 0·2256. There *were* reduced of Cu:	Amount of H Cl (6 x normal strength) used.	If all levulose, and *only* levulose, were destroyed, there would be reduced of Cu = 0·2238. There *were* reduced of Cu:	Time of boiling, in hours; am't of H Cl (6 x normal strength) used.	If all levulose, and *only* levulose were destroyed, there would be reduced of Cu = 0·2238. There *were* reduced of Cu:
1	0·2865, 0·2875 } 0·2870	60 C.C.	0·2280, 0·2252 } 0·2266	3 h'rs. 120CC.	0·2182, 0·2152 } 0·2167
2	0·2404, 0·2416 } 0·2410	120C.C	0·1952, 0·1986 } 0·1969	6 h'rs. 60 C.C.	0·2088, 0·2108 } 0·2098
3	0·2347, 0·2370 } 0·2359				
4	0·2280, 0·2252 } 0·2266				
6	0·2088, 0·2198 } 0·2089				

(*To be continued.*)

SUGAR IN INDIA.*

A communication has been received from the Secretary of State for India, enclosing a memorandum on the cultivation and manufacture of sugar in India by Messrs. Thompson and Mylne, of Beheea, Bengal, suggested by the remarks of Messrs. Travers and Sons, already printed. The following particulars are abstracted from this memorandum :—

There is no doubt that the quality produced per acre in India is much below the average of most other cane-growing countries, and the quality also of the first products is very low; but in making any comparison, and in considering what should be aimed at in endeavours to secure a larger yield per acre, as well as improvement in quality, there are several points of essential importance which need to be kept in view.

The first is that the great bulk of the sugar cane grown in India is not, and cannot be, planted in large blocks or "plantations," by either native or European "planters," under conditions which would render it possible to deal with large quantities of cane or juice at central factories, and profitable for capitalists to invest in the expensive scientific appliances requisite for the "modern processes" which Messrs. Travers refer to.

Nearly the whole of the two and a half or three million acres of sugar cane planted in India is grown by native farmers, who put in a patch of cane in their holdings, of such size as suits them, in rotation with other crops. To ensure success, plans for improving either cultivation or manufacture should be arranged with reference to this important factor.

Another material point is that, in most districts, each farmer crushes his own cane in the field or village, and converts the juice on the spot into *gur* or *rab*, for which he finds a ready market in the local bazaar. In some districts the custom is that several cultivators join in the

* From the *Journal of the Society of Arts.*

purchase or hire of a mill, evaporating pan, &c., sharing these and other expenses of crushing and making *gur* or *rab*, but each man arranges independently for the cutting and carrying of his own cane, also of disposing of it as he pleases, just as they do with their other crops.

Another point of importance is that the bulk of the sugar cane now planted in India is grown and manufactured for local consumption, not for export, and the form or character given to it is that which (unless and until the preferences and prejudices of the people can be altered) renders it most readily saleable in the local bazaar. There are districts which produce a considerable quantity in excess of what is consumed locally, but the surplus is required for other districts which do not grow sugar at all, or produce less than they consume. Seeing that India now exports to Europe less sugar than was sent out twenty or thirty years ago, many merchants, refiners, and others imagine that less is grown and made in India now than was formerly; but the truth of the matter seems to be that a much larger quantity is now produced than at any time previously, and that it can now be sold in the local bazaars at such rates for consumption in India that it would not pay merchants to buy for export. The increase in consumption arises from the improved circumstances of the people, and notwithstanding that much more is produced, a considerable quantity is now imported from Mauritius and other places. One explanation of the consumption is that a great deal more is taken by the millions who grow cotton, jute, wheat, oil seeds, and other products, for which outlets have been created by railways and steamers, and for which such large sums have been received by the cultivators; also the improved means of the large numbers who, during the last thirty years, have found employment in the jute mills and presses, cotton mills and presses, tea gardens, iron works, collieries, railways (construction, maintenance, and working), and other industries which have been established. These have been making much higher wages than the same class would do previously. In Britain, America, and some other countries, when work is abundant and wages good, the masses consume more largely beef, mutton, tea, and such articles, as well as sugar; but in India it is extra sugar in various forms, both for daily use by the family, and at marriages, festivals, &c., which is chiefly used.

Another point of importance is that the fine white crystallised sugar, with large crystals, so much appreciated in Europe, is not at all in favour with, and is, in fact, avoided by the masses of India, if they see any reason to suspect that bone-charcoal, blood, or any such articles (impure to them) have been used in making it. So strong is this feeling and objection, that dealers frequently find it pays to smash up the large crystals to fine powder, which they then sell as native-made Benares *cheenee.*

Another thing to be noted is that (apart from Cossipore, Rosa, Aska, and one or two other places, in all of which exceptional conditions have existed), the profitable carrying on of central factories, by purchasing a sufficient quantity of cane at reasonable rates from those who grow it in their small plots, is not practicable. There are several cogent reasons for this, one being that the rates such factories could pay for cane, which must be carted several miles, would be considerably less than the cultivators would realise by crushing it themselves and making *gur* or *rab* on the spot. Another is that, in most of the cane-growing districts, there are arrangements—customs (established *dustoors*), with regard to crushing the cane, and evaporation of the juice—which entitle the local carpenters, blacksmiths, *kandoos*, and other recognised institutions in each village, to a share of the produce, rendering it difficult for the cane-grower to dispose of his crop in any other than the usual way.

After describing the unwieldy machines formerly in use, Messrs. Thompson and Mylne write:—By novel contrivances and arrangements, a light portable mill was produced, which proved to be so well adapted to the wants, means, and domestic arrangements of cultivators who grow cane in small plots, that it has, in a few years, been adopted in hundreds of districts, not less than 200,000 being now in the hands of the people.

So great an improvement did it prove to be, that, in a village in which the greatest area of cane the cultivators could crush, previously, was about 30 acres, they planted, a very few years after these mills were first placed within their reach, and with them worked off 250 acres, while, last season, they have grown and crushed about 600 acres. The completion of the Sone canals, and construction of village channels to convey the water to their fields for irrigation, has been another main cause of this large increase, but without the improved

mills for crushing, it would not have been possible for these cultivators to have worked off more than 50 acres at the outside.

In the hope of finding a kind of cane which would yield more or richer juice, and at the same time suit the soil and climate, seed cane was obtained from Lower Bengal, North-West Provinces, Penang, Java, Mauritius, and other places. Portions of each were planted in the way usually adopted in Behar, and some according to the methods found most advantageous in Mauritius and other places, several kinds of manure being also used. These trials appear to have started efforts to improve, but it has been found that none of the thick soft kinds would suit in Behar, and those which give the best results are what are locally known as "Mongoo," "Pansaihi," "Barook," and "Bhoorli." The latter is being more largely planted lately because it stands better than the others in wet soil, of which there has been a considerable increase in Shahabad since the opening of the Sone canals. Endeavours were next made to effect some improvement in the method of dealing with the juice. Mr. Alfred Fryer, an eminent authority on sugar and sugar refining, has said that "cane juice, from the moment it leaves the cells, should be treated with the same care and cleanliness as is new milk in a well ordered dairy;" but the practice of the cane growers of India and their helpers was, and, for the most part, still is, the exact reverse of this.

The tenants of the Jugdispore estate were urged to exercise more care, the reasons for, and the advantages of doing so being explained to them, and a few of the most enterprising were induced to go so far as to put a strainer over the mouth of the earthen vessel used to catch the juice as it comes from the mill, and so intercept trash, leaves, dust, &c., also to wash out (or rinse) the "receiver" each time it was used, and to fumigate it by inverting it over a pinch of burning sulphur.

The result was that *gur* and *rab* of a much higher quality were obtained; but here came a difficulty, such as in India frequently occurs to hinder improvements. These men, by taking trouble, have obtained a superior article, but found they could get no more per maund or per cwt. for it than could have been obtained if all the dirt had been left in, and if no care had been taken.

It was not only an article unknown but was suspected, so that

efforts had to be made to find purchasers who could appreciate it, and, amongst others, Marwaree dealers, from places 1,000 to 1,500 miles distant, were convinced that as it saved them paying rail freight for those long distances at the rate for sugar on so much trash and dirt, on this ground alone, apart from other advantages, it was well worth their while to give a higher rate for it. The Rosa refinery also, 500 miles away, found that even with rail freight for this distance to be added, they could pay more for this clarified *gur* than they could for the ordinary qualities in districts much nearer Shahjehanpur. A further step was taken to try and devise some simple, inexpensive apparatus and method, by which cultivators of small plots, who crush their own cane, could produce sugar similar in character to that which Messrs. Travers describe as "simply raw sugar properly made by modern processes." In connection with these efforts Messrs. Manlove, Alliot, Fryer, and Co. were consulted, and they, taking much trouble as well as interest in the matter, constructed for the experiment a novel form of Wetzel evaporator, with small steam boiler, fitted with special safety valve and other arrangements to admit of its being used by villagers having little experience in the management of such machinery or processes. They also made for the experiment a specially contrived portable centrifugal or spinner, by which high speed could be obtained with hand power.

Open evaporator, filter, and other appliances were made locally, and a second Wetzel was subsequently obtained from Messrs. Manlove and Co. These experiments (commenced in 1873) have been carried on from year to year since, and, at an early stage, proved quite successful as regards the quality of sugar produced; but as no good market could be found for the molasses, of which there was a considerable quantity, the indication for sometime was, that the process must involve decided loss, unless a distillery were set up to work off and utilise the molasses. As making spirits was no part of the programme, and as there was no inclination to do this, the project of success seemed far from promising, when it was found that, by careful evaporating the molasses in the shallow pan used for the first evaporation of the juice in making the *rab*, a very saleable *gur* could be obtained, which, being made from the molasses thrown off from the centrifugal, and strained through grain sugar (itself made from clarified *rab*), was speedly recognised as being specially clean and pure,

and so is, from year to year, increasingly appreciated. Thus a way was shown by which the millions of Indian cane growers may secure greatly improved products and higher returns from their crop without any large, expensive, or complicated machinery, with only a small portable mill to crush their cane, an open shallow evaporating pan, a few *nánds* (cheap earthen vessels), in which the *rab* is placed for eight or ten days, to let the crystals form or grow, and a portable centrifugal, any or all of which appliances the cultivators can hire or buy.

It will be seen that the chief aim of these arrangements and experiments has been (1) to secure a better cane crop, and (2) to put the cultivator in the way of getting more sugar from the cane.

Depôts for supplying these machines were opened in various North-Western Provinces districts; and in June, 1888, Mr. J. B. Fuller, then Assistant Director of Agriculture, North-Western Provinces (now Commissioner of Agriculture and Settlements, Central Provinces), wrote regarding results obtained with the new machines, as compared with the *kolhu*:—"If we may apply the result of this experiment to the total production of sugar in these provinces, it follows that, by the substitution of the Beheea mills for the *kolhu* now used, the total annual produce would be increased by the value of nearly a crore and a quarter of rupees," *i.e.*, a million and a quarter sterling. The benefit has been increasing year by year in the North-Western Provinces, as in other parts of India. In the Punjab, also, depôts were opened, and a district committee of leading cultivators reported to the Director of Agriculture (Colonel Wace), after trials made in 1888, that the money gained per season, by using even the smallest size Beheea mill, instead of the "belua," was about Rs. 360; and that it gave "other important advantages." Similar results were obtained in the Central Provinces, Madras, Lower Bengal, and other parts of India.

UNITED STATES.

Report of Experiments in Cultivation of Sugar Cane, Sorghum, and Beet, and Production of Sugar.

Through the courtesy of American Government officials we have received during the past quarter a number of the very exhaustive and interesting reports which form such a characteristic feature of the working of the Department of Agriculture in the United States. Too much praise can hardly be bestowed either on the painstaking and laborious work of which these reports furnish complete evidence, work which cannot fail to bear ultimate fruit because of its careful and systematic elaboration, or on the manner in which the results are presented to the public at no little extra labour and considerable expense. We propose to go through such of these as bear on the sugar industry, making such extracts as our limited space will permit from those portions which are likely to interest our readers.

The first in the series is the fourth annual report of the Agricultural Experiment Station of the University of Nebraska.

This report contains, besides some 40 pages of introductory matter, 267 pages demy 8vo. of reports on the work done at the experimental station at Lincoln, Nebraska, of which Article I., Experiments in the Culture of the Sugar Beet, occupying 83 pages, is the one which immediately interests us. The report bears the names of H. H. Richardson, A.M., and Rachel Lloyd, Ph.D., the former being the director and chemist and the latter the assistant chemist of the station, and covers the twelve months from July 1, 1889, to June 30, 1890. The following extract from the opening statement explains the object with which the experiments have been conducted:—

"Previous to this time no systematic attempt has been made to determine, experimentally, whether or not beets can be raised successfully in this State for sugar manufacture. In 1872, beets raised on the Industrial College Farm, for stock feeding, were analysed and found to yield over 15 per cent. of sugar. Nothing further had been done in Nebraska, so far as we can ascertain, until the spring of 1888, when the people in and around Grand Island made a systematic attempt to demonstrate, experimentally, that beets could be raised, in that locality, of sufficient richness in sugar to warrant the investment of capital in a sugar plant at that place. In order that there should be no doubt as to the actual sugar-content of these beets, samples

were sent for analysis, to various laboratories in this country and in Europe. The samples sent to this laboratory were analysed by Prof. Lloyd, who, at the request of the Hon. Robert W. Furnas, Secretary of the Board of Agriculture, read a paper before that body, January, 1888, giving a summary of the various analyses prior to that date.

"The results of the Grand Island experiment, in raising sugar beet, were so satisfactory that we determined to try and extend the work of experimentation throughout the entire State during the season of 1889. By asking the co-operation of the farmers in collecting reliable information concerning the amount of ground planted, kind of seed sown, cultivation given, &c., we hoped to gain valuable facts to aid in solving the problem before us."

To this end a circular was inserted in the papers and sent to individual farmers inviting those who were growing beet to send in samples for analysis, with full details of variety sown, number of acres planted, dates of planting and harvesting, yield and cost per acre, price per ton at factory, &c. Repeated analyses were made of the beets sent in at various times, the results of which are given in elaborate tables. As might be expected, these results vary in a most extraordinary degree, the percentage of sucrose ranging from 2 to 22·28, and the tables can only be of practical use to those who have access to the whole of the details respecting soil, cultivation, and manipulation of the various qualities grown. Some of these details are given in the tables, the two varieties most generally grown being the Vilmorin and Lane's Imperial. How unfair any possible comparison with results in Europe would be may be inferred from such remarks in the report as the following :—

"Judging from the data given but little attention has been paid to the matter of cultivation."

"Not only were the mass of the farmers unacquainted with the best methods of raising beets for sugar, but in many cases ordinary cultivation was but sparingly given, judging from the reports sent with the beets. It is perfectly safe to say that in no cases were the roots given the thorough and elaborate cultivation of the European farmer."

The season of 1889 was a fairly favourable one for the beet. Out of 166 samples received there were 61 in which the saccharine content reached 12 and over.

The attempt to ascertain the cost and yield was a failure. In all

probability the beets sent for analysis were often not the best, size rather than quality being looked to. No fertilizers were used, as far as appears from the report, and possibly the best soil was not selected. The report gives elaborate instructions as to soil, preparation, manure, time for sowing, &c., and it is evident that the matter is receiving careful attention. On the whole the conclusion was fairly reached that there is no reason why good sugar beets should not be raised in Nebraska in considerable quantities, as long as the State is satisfied to continue the bounties now paid, in addition to that paid by the U.S. Government and the encouragements which the Congress has been asked to grant. The question of temperature and rainfall in Nebraska, as compared with those of the beet producing countries of Europe, is fully discussed in the report and illustrated by tables and charts.

Following on this is Bulletin No. 16 of the same experiment station, detailing the work of 1890. The irregular results obtained from the previous experiments, where no proper control of the modes of cultivation, yield, &c.,—could be maintained, appear to have induced the directors to establish a number of sub-stations where beets could be grown on equal sized plots and under proper inspection, while at the same time seed was issued to about 2,000 farmers, with full directions for cultivating, and a series of tabulated questions.

The sub-stations were roughly grouped into three districts, and the average results as regards yield give a weight of about 17ozs. for the beets, with a saccharine content of nearly 14 per cent. and a purity of 78. But as regards the cost of growth and the yield, the attempt to get data appears again to have failed, and we think it unlikely that any reliable statistics will be obtained for some time to come. We are all familiar with the difficulty of getting any definite statements from the average farmer on these and similar points (see our article on Home-Grown Sugar, *Sugar Cane*, May, 1891, pp. 242-3, for the difficulty experienced by Dr. Schack-Sommer in getting the English farmers to see their own interest), and though the American agriculturist is undoubtedly far more progressive than his British representative, this point will, we think, have to be determined by the State authorities from their own experiments. As regards the weight grown per acre, the figures quoted by (only) nine of the farmers whose reports are given in detail are 7, 8, 10, 15, 16, 16$\frac{7}{8}$, 20, 24, and 30 tons respectively. The tables, which are voluminous, again show very great variation, but the saccharine content of these

farmer-grown beets, ranging from under 5 per cent. to 21 per cent., shows a good steady average of over 14 per cent., the cultivation having in most cases been of the most elementary kind. Throughout the statement there runs "a tacit admission that beets did not receive the careful and thorough cultivation which all admitted was necessary." This is a crucial point as to the economical possibilities of the beet growing industry, and forms one of the difficulties ahead of those gentlemen now engaged in promoting sugar-beet growing in England.

Useful papers on best varieties, and insect pests and cultivation by proper implements (the two latter illustrated) are subjoined and the report closes with the following judicious observations :—

"It must not be lost sight of that the results reported in this bulletin are from high-bred seed and were obtained in spite of new soil and unskilled cultivation. Should these beets be used to produce seed, it is altogether probable that in the beets raised we should see a great deterioration in sugar qualities. We must learn and appreciate the fact that to grow beets for sugar requires a high grade of agricultural talent. Slovenly farming here cannot be productive. We must have high-class, thoughtful, intensive cultivation. Because, with seed produced abroad under such conditions, we, in our novitiate and with new soils, have for once produced high-grade beets we must therefore assume that high cultivation is unnecessary. The tendency of all high-bred stock is toward deterioration, and unless kept up by judicious selection and careful cultivation, it will soon revert to its original state. For this reason beet seed production is a special business, and can only be successful in the hands of men who can give much time to the study of the question, and who have capital to carry out much financially unprofitable work. It is not advisable, then, for farmers to attempt, at present, to raise seed even from their best beets. Until the business of raising beets for sugar finds a home here, and we have become skilful in this branch of agriculture, we must depend for our seed on the seed growers of Germany and France.

Nothwithstanding this, and even if we never have another sugar factory in the state, it will be a paying investment for every farmer to raise one measured acre, at least, of beets, giving them the most careful and scientific cultivation possible.

Summary.

1. These results are from experiments covering an area of over 75,000 square miles of territory.

2. Beets equally good for sugar-making purposes have been produced in all parts of the state.

3. Of the varieties grown this year the Klein Wanzlebener has given the best total results in the northern part of the state, Vilmorin was the best in the middle section, and Desprez gave the best results in the southern section.

4. The season has been the most trying one for the farmer that the state has known for ten years.

5. Beets in all parts of the state have suffered less than any other crop. Where grain and grass have been total failures from heat and drouth, beets have been fair in yield, rich in sugar, with a high purity coefficient.

6. Over five hundred farmers in the state sent beets, grown by them, for analysis. The result from these analyses ranged from 1 to 23·2 per cent. sucrose.

7. To grow beets successfully, for sugar production, requires intensive farming.

8. To bring sugar capital into the state it is necessary to give satisfactory answers to the following questions:—

(a.) Are our beets sufficiently rich in sugar?

(b.) How much does it cost the farmer to raise sugar beets?

(c.) What average tonnage yield can be safely counted on?

9. An affirmative answer has already been given by our investigations to the first question. The farmers themselves must answer the others. By following for two years the suggestions made in the body of this pamphlet in regard to growing measured plots of beets, results may be obtained that would ordinarily require ten years to reach.

10. Beet culture should not interfere with the growing of other crops; it should, by a proper system of rotation, increase the productiveness of the soil and enhance the value of all other farm products."

REPORT ON EXPERIMENTS WITH SUGAR BEETS IN 1880.

By Harvey W. Wiley, Chemist of N.S. Department of Agriculture, &c., &c.

This report embraces experimental work in Nebraska, Florida, Kansas, &c. In the prefactory note Professor Wiley remarks:—" So conclusive have been the results obtained as to fully justify the action of the Department in establishing a culture station at Schuyler,

Nebraska, for the more exact study of the conditions of the most successful methods of growing sugar beets in this country."

We give the following extracts:—

Purchase and Distribution of Seeds.

"From Mr. Henry T. Oxnard, the Department purchased three tons of sugar-beet seed, of which the greater portion was the variety known as the Klein Wanzlebener, grown by Dippe Brothers, of Quedlinburg, In addition to this, however, smaller quantities of the White Improved Vilmorin were purchased, together with the varieties of beets grown by Lemaire, Simon Legrand, Florimond, and Bulteau Desprez. These different varieties were put in one-pound packages and sent to over one thousand different persons who had made special inquiry for them. Accompanying these packages were directions for preparing the soil and planting and cultivating the beets. Directions were also sent for harvesting and sampling the beets and for sending samples to the Department for analysis. Nearly one thousand samples of beets were received by the Department, of which the analyses were made and the results communicated to the farmers sending them. In addition to this work a large number of the beet plots were personally inspected by agents of the Department, and particular inquiry was directed to a large number of farmers in regard to the methods of cultivation which they had pursued.

"Only in a few instances were the directions of the Department followed out to the letter. In most cases the planting and cultivation of the beet seed were conducted according to such methods as the agriculturist might hit upon at the time."

"It was not thought best the first year to make any effort to obtain from the farmers the exact yield of their beets per acre. The difficulty of securing such information is almost insurmountable. In the first place the amount of land under cultivation is usually guessed at, and in very few cases are exact measurements made. The results, therefore, at best are only estimates unless the absolute control of measurements and weights can be secured."

Financial Returns to Beet-growers.

"In general, the following remarks may be made concerning the last season's work in the beet-sugar industry, from a commercial point of view, in Nebraska and Kansas.

"The summer in both localities was exceptionally dry. For this reason and on account of lack of knowledge among the farmers in

regard to the proper methods of raising beets the average crop was very short. In Nebraska the exact tonnage cannot be known, but probably it would not average more than 2 or 3 tons of beets per acre; in Kansas the average seems to have been somewhat higher. In many cases farmers obtained 10 and even 15 tons of beets per acre, showing that even in adverse conditions of season a reasonably large crop may be harvested when all other conditions necessary to the proper growth of the crop are attended to.

"As might well be expected from the small yield, the farmers in general were dissatisfied with the season's work. It is not reasonable to expect satisfaction from a crop of so low an average when the labour of growing it is so great; but while the farmers are dissatisfied it must be confessed that a great deal of this dissatisfaction must be attributed to their own lack of knowledge of the subject or to their disinclination to put upon the beet fields the proper amount of labour and culture at the proper time. Instead of being therefore deterred from continuing the production of sugar beets, it would seem wiser on the part of the farmers to study carefully the methods of agriculture pursued by those who made a success of beet culture, and to imitate those methods during the coming season. The fact should not be forgotten, however, that even with the poor results obtained the beet crop was uniformly better than the average of other crops in the same locality.

"It would be useless to hold out to the farmers the hope of financial reward from a beet crop which would average only 3 tons per acre; but if from this acre he could produce 10 to 15 tons of beets then his venture would prove financially successful. In order that the manufacture of beet sugar should become an established commercial success, the factories and the farmers must work in harmony. The method pursued in France and in Germany would probably be best suited to bring about this result. In those countries the beet growers themselves are usually shareholders in the factories, and thus participate in the profits. It is probable that the annual dividends of German and French beet-sugar factories do not fall below 10 per cent. net on the capital invested. The farmer, therefore, who has even a small interest in such a factory secures a handsome profit on his invested capital. At the same time he has a vote in the board of directors and is personally interested in the success of the factory. In many factories of Europe the stock is thus held by the beet-growers. If, on the

other hand, the whole of the factory be owned by the capitalists, then there is a cause for continual conflict between the interests of the farmer and the interests of the manufacturer, although this conflict is perhaps more in theory than practice. Even if the factory be owned exclusively by the capitalists, it is to their interests to work in harmony with the farmers, in order that they may secure a crop of sufficient magnitude to render the operation of their factory profitable.

"It perhaps, however, would be unavoidable at the beginning of the industry that a feeling of animosity should exist between the beet-grower and the manufacturer. After a few years the prices to be paid for beets and other agreements with the farmers will doubtless be adjusted on a scale of equity and satisfaction to all concerned. In case farmers have no money to put into beet-sugar factories they might take shares of stock and pay for them with beets during the first and second years; in this way they would secure a financial interest in the company, own their shares of stock, and pay for them from the proceeds of the field without investing in ready cash. By adopting some such plan as this it might be possible to get every beet-grower within reach of the factory to become himself interested as a stockholder.

Wisconsin.

"The analyses of sugar beets grown in this State during the last season have a very wide range, viz., from 6·39 to 18·79 per cent. of sugar in the juice; of the 95 analyses given in the above table, 19 come below 10 per cent. of sugar, 56 come above 12 per cent., 38 above 13 per cent., and 16 above 15 per cent. of sugar in the juice. But very few of the farmers who sent in beets for analysis had previously had any experience in growing beets; besides this some of the beets were grown for stock food, with no intention of testing their sugar-producing capacity. Bearing this in mind, it would seem that the showing is a very creditable one; where growing for sugar, and where good care was bestowed, the beets contained a high percentage of sugar. As regards the yield, but very few and uncertain data were obtained, most of the farmers having grown only small plats, from which an estimated yield was reported." * * * "A continued study of this subject may disclose other sections where sugar beet culture may be conducted successfully. The work has just been entered upon. From what has been done at this experiment station and at sub-stations in different parts of the State, it is known that good crops of beets can be grown of a good quality. While the

results reached so far would indicate that Wisconsin may prove well adapted for the culture of sugar beets, the work must be repeated for several seasons before the question can be considered as fully settled.

Fort Scott, Kansas.

"A few of the samples showed good qualities for sugar making, but the most of them had too low a content of sugar and purity to be of any value for the manufacture of sugar.

Topeka, Kansas.

"Quite a quantity of beets was brought to the factory at Topeka, and an experimental run was made with them. The number of tons of beets used was 22. The juice from the samples of beets entering the battery was found to contain 15·36 per cent. of total solids and 9·30 per cent. of sugar.

"It will be noted by the above figures that the quality of the beets was worthless for sugar-making purposes."

Medicine Lodge, Kansas.

In addition to the analyses and control of the sorghum work, extensive examinations were made of the beets grown in this locality. The season was a peculiar one for beets.

"The fresh chips entering the battery had a mean sucrose content in the juice of 13·90 per cent., much less than that represented by the analyses from the different loads, viz., 15·12.

"The diffusion juices show a content of 10·45 per cent. sucrose, and a purity of 81·2.

"The working of the beets with the sorghum-sugar machinery was extremely slow, and either from this cause or from the method of liming, which was very heavy without any subsequent use of carbonic acid, the clarification and boiling of the juices became a matter of great difficulty, and they suffered in this process rapid deterioration; for instance, the purity of the clarified juice was only 78·8, and of the syrup 78·3, while the mean purity of the masses-cuites showed the enormous depression represented by the difference between 78·8 and 59·4. The actual cause of this remarkable deterioration in boiling is not well understood. The juices boiled with the greatest difficulty, it being almost impossible to prevent them from foaming in the pan. The semi-syrups also, after standing for a time, deposited a large quantity of mucus or viscous material, and this would lead to the supposition that a pernicious fermentation of a viscous or mannitic

nature was the cause of the great loss of sugar during the boiling operations.

"It is evident at once that the attempt to make beet sugar without appropriate apparatus must be regarded as futile. Beets of the quality of those delivered at the Medicine Lodge factory, if they had been properly and promptly manufactured, would have yielded almost 250 pounds of sugar to the ton; instead of this the yield was extremely small, the separation from the masse-cuite very difficult, and the whole manufacturing process disappointing.

"The splendid results obtained at Medicine Lodge in the working of sorghum cane would seem to indicate the course which the sugar industry should follow in that locality. Everything indicates that the culture of sorghum sugar will prove a success while there is little to encourage the further development of the beet-sugar industry in that locality.

GENERAL CONCLUSION.

"The result of the analyses at Grand Island and other places show that beets of high sugar content and great purity can be grown in many parts of the United States. The average size of the beets, however, in many places is too small to assume that their culture would prove profitable. It would be far better for all interests to grow beets averaging from 600 to 700 grammes in weight, even if the percentage of sugar should drop one or two points. The causes of the small crop at Grand Island (mainly drought) have already been set forth, and it is not necessary to repeat them here. The Department has organised an experimental station for the culture of the sugar beet at Schuyler, Nebraska, and it is confidently expected that rich beets with high tonnage can be produced."

It is to be noted that in any data given, the percentage of sugar is reckoned on the weight of the beet itself, and not on the juice, unless otherwise specified.

"The production of beets containing from 15 to 18 per cent. of sugar is not unusual, and such beets may be regarded as strictly normal in constitution, but possessing a particularly high content of sugar. When, however, the content of sugar in the beet exceeds 18 per cent. it must be regarded at the present time as something abnormal and due to peculiar conditions affecting the particular locality, or even the particular plant itself. Such beets are usually extremely small in size, and the richness of their sugar content has been acquired at the expense of normal growth.

"The great hope of uniform production of sugar beets high in sugar-producing power in the United States must be found in the establishment of culture stations where different varieties of beets can become fully acclimated, and where they can receive the same careful scientific culture and selection which have brought them up to their present state of excellence in Europe."

From the report of the Louisiana Experimenting Station, at Baton Rouge, of which Dr. W. C. Stubbs, the Official State Chemist, is the Director, we take the following:—

"*Analysis of 25 varieties of Sugar-cane grown at the Station this year (1890).*

Variety.	Total Solids.	Sucrose.	Glucose.	Solids not Sugars.
Purple	15·0	12·1	2·65	0·25
Striped Mexican	16·0	12·4	2·00	1·60
Rose Bamboo	12·8	9·9	2·77	0·13
Hanuala	12·4	7·4	2·94	2·06
Ohia	13·1	9·1	4·07	0·93
Papaa	12·6	7·3	4·24	1·06
Otaheite	14·4	8·7	4·24	1·46
Kokea	13·5	9·5	3·41	0·59
Lahaina	13·3	8·7	3·65	0·95
Akiolo	13·8	7·8	5·04	0·96
Ainakea	12·4	7·4	4·66	0·36
Crystallina	16·5	12·9	3·21	0·39
Yellow	14·1	9·3	3·12	1·68
Kanio	9·9	3·0	2·70	1·20
Cavengerie	11·0	6·0	4·07	0·93
Loucier (No. 1)	14·0	8·7	4·68	0·62
Green	14·0	9·0	3·03	1·97
Bourbon	14·5	11·3	2·04	1·16
Black Java	15·5	12·9	1·73	0·87
Portier	13·4	9·1	2·69	1·61
Blanca d' Otaheite	13·5	8·5	4·08	0·92
Loucier (No. 2)	12·5	7·6	3·92	0·98
Japanese	15·1	9·0	3·29	2·81

"These analyses are quite low, but this is easily accounted for by the fact that these are all foreign varieties and are now undergoing a process of acclimation. After this process is completed some of these may prove very valuable sugar producers."

Some additional very interesting reports from the United States must perforce lie over for another month, as the extracts we should like to give will be too voluminous for the present number of our magazine.

UNITED STATES SUGAR PRODUCTION.

The relative position of the different sugar producing States and the kind of sugar produced, are well indicated in the following table given in the New Orleans *Picayune*, and taken from the report of the Internal Revenue Office:—

	Establishments.		Products, pounds.
Cane sugar—			
Louisiana	704	..	550,600,000
Texas	15	..	14,807,000
Florida	11	..	3,581,500
Total cane sugar	730	..	568,988,500
Sorghum sugar—			
Kansas	3	..	2,500,000
Beet sugar—			
California, Nebraska, Utah and Virginia	7	..	29,210,000
Maple sugar—			
New Hampshire and Vermont	3,200	..	5,000,000
Other sugars than cane	3,210	..	36,710,000
Total	3,940	..	605,698,500
			or, 270,400 tons.

This table shows clearly that Louisiana supplies more than 90 per cent. of all the sugar produced in the United States, and when we consider the still doubtful success (as we think it), of the sorghum sugar industry, and the fact that the beet sugar industry appears, as yet (excepting in California), to be mainly sustained by the special local bounty granted in Nebraska,* it is abundantly evident that Louisiana is likely to remain for many years, if not for all time, the great sugar producing State of the Union. Her planters and manufacturers have for years been fighting an up-hill battle, which would have daunted the courage of most other people who had to contend with similar discouragements, and it is by no means certain that much money is even now being made by them, but they pursue their course with cheerfulness and determination, and really set an example of enterprise and energy to all engaged in the difficult task of sugar growing to a profit.

The estimated quantity of sugar production for the coming year, based on the applications for license sent in to the Treasury, is somewhat lower than the above figures, say 550,000,000 pounds, of which 500,000,000 pounds are cane sugar, and 30,000,000 pounds beet. Another estimate makes the quantity much larger.

* Now proposed to be withdrawn.

BEET CULTIVATION IN THE AUSTRO-HUNGARIAN MONARCHY.

We have before us the following papers on this subject.—

SUGAR-BEET CULTIVATION IN AUSTRIA, a paper in the *Journal of the Royal Agricultural Society of England*, quarterly number, issued June 30th, 1891, by Mr. Ernest Clarke, Secretary to the Society.

THE SUGAR-BEET INDUSTRY OF BOHEMIA.—Report by Commercial Agent (U.S.A.), Hawes, of Reichenberg.

Both these papers, the latter of which is voluminous, are of special value, from the fact that they contain information collected on the spot, Mr. Hawes being a resident in the district where he obtained his facts, and Mr. Ernest Clarke having had every facility afforded him, during a visit to Austria, in 1890, on the business of the International Agricultural Congress. The interest in each case consists in the fact that both in this country and in America—in England tentatively, in the United States in a more practical form—the question of sugar-beet cultivation is exciting considerable attention. Mr. Clarke quotes, among other information which we do not need to repeat, the axioms of sugar-beet growing, from the well known report of Dr. Wm. Mc.Murtrie to the Washington Agricultural Department, but we propose to give some excerpts from his very useful paper which will speak for themselves, and refer those interested to the Journal itself, which can be obtained from John Murray, Abermarle Street, London. The two factories from which Mr. Clarke derived his information are those of Lundenburg and Wischau. At the former there are eight, and at the latter ten farms, of the respective total areas of 7,050 and 5,800 acres. In regard to the position of the Continental Beet-Sugar Industry, Mr. Clarke says:—

"In the discussions which have of late taken place as to the possibility of growing sugar-beet in this country, the allegation has been made that the system of bounties practised by foreign nations is the only real impediment in the way of its profitable cultivation in the United Kingdom. It is undeniable that equally good sugar-beets can be raised in England as on the Continent; and if countries like Holland, Belgium, and Northern France, with climates very similar to our own, can grow beet successfully, there appears no valid reason from the agricultural point of view why we should not have home-

grown sugar. The crux is, Can we grow it at a profit, in view of the competition of bounty-fed sugar from abroad? This it would be foreign to my present purpose to discuss. Moreover, the question of bounties is one of high complication, and a recent attempt by our Government to deal with it by an International Convention met with disastrous failure.

"The augmented consumption of sugar by the people, the remarkable changes in its countries of origin, and the extraordinary increase in the production of beet sugar as compared with that from cane, are all facts of extreme economic importance. It is not perhaps generally recognised that whereas thirty years ago beet sugar only represented about one-fifth of the total production of the world, it now represents more than a half. The subjoined table shows this very strikingly, though it must be stated that 1889-90 was an exceptionally favourable year for beetroots:—

The World's Production of Sugar during the last Seven Years.

Year.	Beet Sugar.	Cane Sugar.	Total Production.
	Tons.	Tons.	Tons.
1883-1884	2,361,000	2,323,000	4,684,000
1884-1885	2,546,000	2,351,000	4,897,000
1885-1886	2,220,000	2,340,000	4,560,000
1886-1887	2,730,000	2,345,000	5,075,000
1887-1888	2,452,000	2,470,000	4,922,000
1888-1889	2,765,000	2,280,000	5,045,000
1889-1890	3,500,000	2,278,000	5,778,000

"It is seen from the above table that the production of cane sugar has remained stationary or even diminished during the last septennial period, while the production of beet sugar has greatly increased."

The question of soil adapted for the sugar-beet is fully dealt with, and also the rotation which should be adopted in the cropping. The following extracts will show the clear way in which this information is given:—

"There is no soil so well suited for beet as a good, wellworked, deeply cultivated, and thoroughly drained clay-loam; or, in other words, a soil containing a good deal of clay, with a fair proportion of sand. On calcareous soils the roots are generally small, rich in sugar, and yields a juice of great purity.

"Most good clay-loams contain sufficient lime to meet the requirements of the beetroot crop. Many light soils, on the other hand, being poor in lime, are much improved by the application of clay, marl, chalk, or quicklime previous to ploughing up the land in autumn.

"Too much stress cannot be laid upon the necessity of carefully choosing and properly preparing the land intended for the cultivation of sugar-beet. To obtain long, clean, properly shaped roots, the plants must have a sufficient depth of soil to grow in, as nothing fosters the development of side roots more than the stoppage of the passage of the tap root by the hardness or bad quality of the subsoil.

"The most suitable preparation for sugar-beet is a white straw crop, or well-manured potatoes. Wherever possible, beet is made both to follow and precede a corn crop. Clover or 'seeds' should not precede beet, for although the roots grow to a large size and yield well after clover-seeds, they remain poor in sugar and take up too much saline matter from the decomposing remains of the preceding crop. Beet is usually followed by spring wheat. All experience points to the fact that repeated sowing of beet on the same land is ruinous to the cultivator, even where immense quantities of farmyard manure is applied, and where a return is made to the land of all the constituents taken from it by the beet.

"At Lundenburg, the following two sorts of rotations were found, one applied to the heavier soils, and the other to the lighter soils.

Heavier Soils.

(a) Winter and summer wheat, with dung.
(b) Sugar-beet with artificial manures.
(c) Barley.
(d) Rye or Lucerne.

Lighter Soils.

(a) Rye, with dung.
(b) Sugar-beet, with artifical manures.
(c) Barley or Oats.

"At Wischau the rotations were found to be more elastic and to be varied according to circumstances, although alternations were carefully observed. The most common rotations are:—

I. (1) Autumn-sown cereals, (2) Sugar-beet, (3) Barley, (4) Sugar-beet, (5) Barley, (6) Clover, Peas, &c.

II. (1) Autumn-sown cereals, (2) Sugar-beet, (3) Barley, (4) Clover.

III. (1) Autumn-sown cereals, (2) Sugar-beet, (3) Barley, (4) Sugar-beet, (5) Autumn-sown cereals, (6) Sugar-beet, (7) Clover.

IV. (1) Wheat, (2) Sugar-beet, (3) Barley, (4) Peas, (5) Autumn Rye, (6) Sugar-beet, (7) Barley, (8) Sainfoin, (9) Sainfoin and sometimes (10) Sainfoin."

A section is devoted to the way in which the seed is preserved. We doubt the advisability of using any but freshly imported seed for trials in this country. Long experience is required to produce proper seed, and though the question of acclimatisation has its value, yet the best results will certainly, for the present, be got from properly harvested seed selected by experienced growers. Probably the Klein-Wanzleben and Vilmorin strains will be the safest. Other sections deal clearly but concisely with the manner of sowing, cultivation, and harvesting, appropriate illustrations of the machines in use being introduced, and there are also sections on the use of refuse pulp as cattle-feed, and on labour. Mr. Clarke closes with the following general remarks:—

"As to the profitableness of beet cultivation from a purely agricultural point of view, it is not possible to give any very precise information, since the money results of growing the root depend almost wholly upon the price obtained for the manufactured article—sugar. Dr. G. Shack-Sommer, of Liverpool, who has recently made a praiseworthy attempt to direct attention in this country to the subject of beet-growing, says that 'from the very best authorities on the Continent he has gathered the information that the immediate result of opening a beetroot factory in convenient proximity to the growers is to increase the value of land by one-third.' However this may be, it is undeniable that the intensive cultivation of the soil which the beet requires, and without which the growing of it should not be attempted, improves the land, and enables it, directly or indirectly, to give busy and remunerative employment to a considerable quantity of labour.

"Sugar is now low in price, and the Austrian manufacturers are, like their fellows elsewhere, eloquent as to the meagreness of their profits. Those of them who have made contracts for a term of years with farmers to supply roots, at rates which now appear to them high, demand a revision of prices, and talk of limiting the production. There is an agitation in Austria, as in England, about the lowering of railway rates, and the Government is chided for not taking steps for the 'development of exports.'

"These are all matters into which it would be impossible for me to dwell here at any length. The fact remains that for some parts at least of Austria the cultivation of the sugar-beet has been the main-spring and the mainstay of all agricultural improvement; and to it is due most of the activity, the progress, and the prosperity of the districts which I visited."

(To be continued.)

TECHNICAL MANAGERS IN SUGAR-HOUSES.

(From the *Revista de Agricultura.*)

We publish, below, an article which has been sent us by our old correspondent, Senor Saillard, which corroborates in every respect what we have constantly maintained in the *Revista* with regard to the necessity of placing fit persons at the head of our sugar-houses, actual masters of all the processes of manufacture, who can not only detect losses suffered and errors committed, but also—and this is in reality their use and advantage—avoid the former, and correct the latter, for which purpose they must possess proper technical knowledge, combined with skill in manipulation, and above all, that prestige and influence which is to be conferred on them by the fact of their being the real and actual managers of the manufacture. The mere fact of setting up a laboratory under the management of a chemist who analyses the juice, syrup, masses-cuites, &c., will produce a contrary result, because it will bring with it an antagonism between the chemist and the sugar-maker. Half-measures in a question of such importance as what is to be, or not to be, will do nothing but make the situation worse, or at the most, indicate the defects without applying the necessary corrective. There is now only one point to be decided in the sugar-house, either to go on manufacturing sugar with a rule-of-thumb sugar boiler, or to choose a technical manager of the whole manufacture, who shall have under his orders all those who are directly concerned with the machinery and apparatus, who is thus able, without any disturbance or hindrance of any kind, to make investigations in the laboratory, and put in practice in the sugar-houses what is necessary, correcting deficiences and defects before they occasion greater damage.

The following is Senor Saillard's article:—

"Ever since the price of sugar was reduced by the remarkable competition between beetroot and cane, planters have had their attention

directed to the processes employed by European manufacturers to obtain their splendid yield.

"From an industrial point of view, there can be no doubt that, next to the means of extraction applied to the raw material, the most important factor is the chemical control employed in all the operations of the sugar-factory. And, after all, what use is it to have a good method of extraction, numerous filter-presses, clarifiers, &c., if these appliances are used blindly, and unless the maximum of efficiency is obtained by them along with the minimum of loss? This being admitted, now that our mannfacturers are borrowing from Europe its energetic and special methods of purification, the moment has arrived for introducing the laboratory and eventually chemical control in the sugar-houses, and if, up to now, this progressive action has not been taken, it is solely owing to two or three prejudices which are very current among mannfacturers, and which the greater part of them have not taken the trouble to consider critically.

"Let us admit, at the outset, that the introduction of a chemist into a factory necessitates also the adoption of troublesome changes, the results of which are not quite certain. This is not absolutely the case, because we might introduce a chemical engineer into the sugar-house on the express and sole condition that he should make the best possible of things as they are; a chemist, using only a reasonable and proper defecation and constant vigilance to hinder inversion, which is always a possibility, can obtain half to one per cent. more yield than can be got by a mere sugar maker (pan-boiler) with his guess-work defecation, without taking into account that the former, by his constant control of operations, can guard against accidents in the series of processes to which the juice is submitted.

"Such an official, knowing the quantity of sugar which enters into and issues from the manufacturing operations, and calculating the losses, is in a position to reduce these to a minimum, and this, I repeat, without changing in any way the plant of the sugar-house; which, further, will not prevent him from indicating the alterations or additions which should be made to attain better and more profitable results.

"In the next place, the greater part of the Cuban manufacturers have great faith in the practical knowledge of the sugar maker, notwithstanding the fact that this famous practical experience is as a rule founded on nothing more than a mass of pre-conceived ideas and vicious

errors handed down from one to the other. Undoubtedly there are exceptions, and I have known very active and intelligent sugar makers who are well aware that science, with its advances, obliges them daily to modify the old industrial practices, but how many others have I known who ought never to leave the pan, because they know nothing but how to granulate.

"The general belief among the workmen in the sugar-house is that it is the pan-boiler who makes the sugar, from which has come the idea that the purification of the juice and syrup is a secondary matter, and that if the one who manages the boiling-pan is clever, large yields of raw sugar can be obtained from juice of inferior quality, which is evidently thoroughly erroneous. In Europe, the manager of the factory, that is, the man who superintends all the operations, receives four or five times the pay of the boiler, whose functions are reduced to merely boiling the syrups which are delivered to him, and even in this he is under the orders of the manager, and, according to the state of the market, receives the order to make fine or coarse grain, dry or moist; and is considered as a good boiler, according as he can with facility change the conditions of his work as circumstances require.

"Science is not requisite in order to know how to granulate well; a man may boil an excellent strike of sugar and be perfectly ignorant of the chemical laws on which a good defecation depends; above all, when, as is the case in many sugar works, a large quantity of raw material containing much sugar is worked up, and only a poor yield obtained. And it could not be otherwise. Where nothing is known, because even the most elementary principles of science are wanting, and consequently nothing is known of density, or rotation power, it is impossible to make any calculation with regard to yield, and the assertions which are made in this respect have to be taken on bare word. How many times have I heard people talking of yield obtained, greater actually than the quantity of sugar which practically entered the boiling-house! And further—to take only this very last season—what losses would be shown if calculation were applied, because of the stupid empiricism with which, in many Cuban sugar works, they have mixed the molasses with the juice!

"Leave the pan to the pan-boiler, and the management to the manager; but let us entrust both the chemistry and the technical

management of the sugar-houses (in which a *chemical* industry is carried on) to the sugar engineers.

"In another article I will indicate my idea of the organisation of a sugar-boiling house in a central factory."

Correspondence.

To the Editor of the "Sugar Cane."

Sir,—The following extract from the *Demerara Argosy* may be of interest to some of your readers who have not heard of the "Kneller Process" as used in the manufacture of sugar:—

"Our planter readers will probably recollect that we gave a description of the above process, and promised to inform them of its success or failure after it had been fairly tried on Mr. Boon's estate, Stonefort, in St. Kitts. The whole of this year's crop, which has been a very short one, fully 40 per cent. below the average, has been made by this process. The shortness of the crop is accounted by the drought which has prevailed throughout the Leeward Islands. In St. Kitts the rainfall for the first five months of this year has amounted to seven inches only. Kneller's process is very simple. Cold air is forced to the bottom of the syrup in the Aspinal pan, and in rising to the surface becomes charged with moisture; thus evaporation is much accelerated and the temperature of the syrup kept down. At Stonefort the thermometer shows that this temperature rarely exceeds 180° F. The sugar from the coolers is centrifugalled, and every evening the molasses from the day's operations is reboiled; this takes about thirty minutes. The first sugar, which is, of course, merely a very superior kind of muscovado, tests from 94 to 95 per cent. It has tested as high as 95·8 per cent., and a special sample, obtained from a layer of larger crystals which forms between each strike in the coolers, tested no less than 98 per cent. The molasses sugar tests 88° and is quite equal in appearance and quality to good muscovado. The bulk of the first sugar has been bloomered and shipped to London with, we understand, very satisfactory results. The molasses from four tons of first sugar yields one ton of second sugar. As regards the quantity of sugar extracted from the juice, and the pecuniary success of the process, we have no figures to lay before our readers, but we are informed that Mr. Boon is very well satisfied with the results obtained. Probably, an application addressed directly to him, by any planter intending to give

this process a trial, for further information will be the best way to obtain it."

The Kneller process, if my memory does not fail me, is no new process. It was tried some years ago in one of the West Indian colonies, and ceased to be used, I believe, because it did not in the end produce satisfactory results.

The Aspinal pan is an open pan, and if by means of the insertion of cold air you reduce the temperature to 180° F. the cane juice must be so much the longer in the pan before it becomes sugar. The low temperature prevents the cane juice from being injured by scorching. You get a better coloured sugar by the process, but at the expense of a larger consumption of fuel. Probably there is, in one of the back numbers of the "*Sugar Cane*," a reference made to this process, only under another name.

I also send you an extract from the *Railway News* of the 15th August, 1891, which will interest your readers:—

"Molasses as a fuel is seriously suggested by a New Orleans journal. The large sugar crop of Louisiana for the present year promises increased trouble of getting rid of the lower grades of molasses, the output of which will probably reach 300,000,000lbs. This molasses is sold for 5 to 7 c. per gallon when a customer can be secured; but the bulk of it is wasted by either running it into huge pits or into the river or bayous. It was formerly converted into rum, and this would seem to be a profitable enterprise at present prices. But it is now proposed to use it as a substitute for coal as fuel on the plantations. Molasses burn with a high heat in combination with wood or wood fibre, so that by sprinkling it on the *bagasse* (the dry stalks of the sugar cane after the saccharine juice has been pressed from it) and excellent fuel of great heat power is obtained."

There is another use of sugar which it is as well to keep before the public. When used in boilers it is said to prevent any sediment adhering to the bottom of the boiler. When a boiler is thus incrusted it takes a larger quantity of fuel to generate steam. Hence the advantage of keeping the bottom of the boiler clean.

I am, yours, &c.,

W. H. JONES.

2, Vermont Road, Upper Norwood, S.E.,
22nd August, 1891.

We regret that the pressure of important and interesting matter compels us to leave over the list of Patents until next number.

IMPORTS AND EXPORTS (UNITED KINGDOM) OF RAW AND REFINED SUGARS.

January 1st to July 31st.

Board of Trade Returns.

IMPORTS.

Raw Sugars.	Quantities.		Value.	
	1890.	1891.	1890.	1891.
	Cwts.	Cwts.	£	£
Germany	4,133,733	3,625,196	2,447,202	2,258,409
Holland	307,460	302,065	174,184	186,306
Belgium	559,820	524,662	306,175	312,288
France	854,040	1,036,069	526,337	685,515
British West Indies & Guiana	927,499	773,665	703,449	610,883
British East Indies	339,322	536,135	170,697	284,740
China and Hong Kong	....	....	....	....
Mauritius	116,591	162,269	74,193	101,314
Spanish West India Islands	....	19,935	....	15,699
Brazil	248,038	372,542	149,085	223,709
Java	833,712	1,374,298	600,840	947,392
Philippine Islands	135,964	505,199	72,926	270,049
Peru	395,941	266,914	264,564	186,601
Other Countries	184,072	313,083	130,386	209,493
Total of Raw Sugars	9,036,192	9,812,032	5,620,038	6,292,398
Molasses	434,606	281,887	139,035	87,525
Total Sugar and Molasses	....	....	10,580,525	11,733,076
Refined Sugars.				
Germany	3,075,333	3,777,782	2,484,865	3,072,666
Holland	1,095,895	959,013	910,371	800,057
Belgium	88,606	104,153	80,317	91,826
France	1,587,629	1,129,802	1,287,854	932,969
United States	67,231	525,529	57,025	441,761
Other Countries	1,268	17,209	1,020	13,874
Total of Refined	5,915,962	6,504,488	4,821,452	5,353,153

EXPORTS.—Refined Sugars.

	Cwts.	Cwts.	£	£
Sweden and Norway	31,416	49,156	22,776	37,434
Denmark	83,991	83,154	51,446	52,398
Holland	52,061	51,032	36,749	36,858
Belgium	17,023	13,365	11,702	9,282
France	4,255	258	2,754	198
Portugal, Azores, & Madeira	53,459	40,585	35,514	28,259
Italy	54,100	25,337	36,617	18,120
Other Countries	142,427	169,047	108,068	125,771
Total of Exports	438,732	431,934	305,626	308,320

IMPORTS OF FOREIGN REFINED SUGAR.

The following figures give the imports of foreign refined sugar for the month of July, 1891, compared with the corresponding month of the two preceding years, and the average monthly imports for the year compared with those of 1888, 1889, and 1890, distinguishing the quantities of "Lumps and Loaves" from "other sorts," and giving the separate imports from each country:—

Countries from which Sugar has been imported.	"Lumps and Loaves."							"Other Sorts." Including Crushed Loaf, Granulated, Crystallized, &c.							Total.						
	Monthly Average.				July	July	July	Monthly Average.				July	July	July	Monthly Average.				July.	July.	July.
	1888	1889	1890	1891	1889	1890	1891	1888	1889	1890	1891	1889	1890	1891	1888	1889	1890	1891	1889	1890	1891
	Tons.	Tons.	Tons.	Tons.	Tons	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France.............	1686	1888	3382	1982	2080	3290	2420	4855	3398	7958	6088	10528	6235	6477	6541	5286	11340	8070	12608	9525	8897
Holland	3267	3005	3263	3222	1100	4018	4193	2675	3074	4564	3628	2895	4946	4294	5942	6079	7827	6850	3995	8964	8487
Germany & Austria..	1510	2964	2808	3027	2669	2421	3575	11729	17245	19159	23957	13094	20708	24508	13239	20209	21967	26984	15763	23129	28083
Belgium	622	995	385	438	354	146	172	227	267	247	306	217	269	421	849	1262	632	744	571	415	593
United States	8	..	41	146	..	58	.	157	98	440	3608	22	492	14	165	98	481	3754	22	550	14
Russia.............	..	..	..	..	20	..	..	1959	4275	..	120	2254	..	77	1959	4275	..	120	2274	..	77
Other Countries	1	14	..	..	2702	..	..	2	10	9	3	2509	..	2	3	24	9	3	5211	..	2
Total	7094	8866	9879	8815	8925	9933	10360	21604	28367	32377	37710	31519	32650	35793	28698	37233	42256	46525	40444	42583	46153

SUGAR STATISTICS—GREAT BRITAIN.

FOR THE FOUR PRINCIPAL PORTS.

TO AUGUST 22ND, 1891 AND 1890.

IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

	STOCKS.		DELIVERIES.		IMPORTS.	
	1891.	1890.	1891.	1890.	1891.	1890.
London	43	31½	191½	177	209	159½
Liverpool ..	49	56	189½	182	184	151½
Clyde	13	22	128	145	114½	140½
Bristol	1	1½	43	45	42½	43½
Total ..	106	111	552	549	550	495

The above figures do not represent accurately, or to the full extent, the position and movements of sugar in the United Kingdom, as Hull, Leith, &c., are not included, there being no published returns for these ports.

SUGAR STATISTICS—UNITED STATES.

(From Willett & Gray's Report.)

FOR THE FOUR PRINCIPAL PORTS. IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND. FOR JULY, 1891 AND 1890.

	STOCKS. August 1st.		DELIVERIES. In July.		IMPORTS. In July.	
	1891.	1890.	1891.	1890.	1891.	1890.
New York	60½	37	58	60	72½	65
Boston	8½	5½	19	17	19½	18
Philadelphia....	7½	6	61	40½	61	42½
Baltimore	2½	—	1	—	1	—
Total......	79	48½	139	117½	154	125½
Total for the year			979½	776	1031	813½

NEW YORK PRICES FOR SUGAR.

From Willett & Gray's Report, August 13th, 1891.

FAIR REFINING.	96o/o CENTFS.	GRANU-LATED.	STAND. A.	STOCK IN FOUR PORTS.
Aug. 13, 1891.—3c.*	3 7-16c.*	†4¼c.	†4 3-16c.	Jan. 1, 1891— 27,756 tons.
Aug. 14, 1890.—5c.	5⅝c.	6⅛c.	5⅞c.	Jan. 1, 1890— 11,169 tons.
Aug. 15, 1889.—6¼c.	7 1-16c.	8¼c.	8c.	Jan. 1, 1889— 32,254 tons.
Aug. 16, 1888.—5 5-16c.	6¼c.	7½c.	7⅛c.	Jan. 1, 1888— 47,798 tons.
Aug. 18, 1887.—4 9-16c.	5 5-16c.	5⅞-15-16c.	5 9-16c.	Jan. 1, 1887—102,279 tons.
Aug. 19, 1886.—4 9-16c.	5 3-16c.	6 1-16c.	5 9-16⅝c.	Jan. 1, 1886— 57,328 tons.
Aug. 20, 1885.—5¼c.	6c.	6 11-16c.	6¼-⅜c.	Jan. 1, 1885— 89,186 tons.
Aug. 14, 1884.—4⅝c.	5 11-16c.	6 9-16c.	6 1-16c.	Jan. 1, 1884— 60,900 tons.
Aug. 16, 1883.—6⅝c.	7 9-16c.	8 11-16c.	8 3-16c.	Jan. 1, 1883— 50,297 tons.
Aug. 17, 1882.—7⅛c.	8c.	9⅛c.	8¾c.	Jan. 1, 1882— 43,927 tons.

* Net Cash.

STOCKS OF SUGAR IN THE CHIEF MARKETS OF EUROPE ON THE 31ST JULY, 1891, FOR THREE YEARS, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining 4 principal entrepôts.	TOTAL 1891.	TOTAL 1890.	TOTAL 1889.
107	92	149	90	13	18	469	400	330

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING 31ST JUNE, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining 4 principal entrepôts.	TOTAL 1890-91.	TOTAL 1889-90.	TOTAL 1888-89.
1373	535	511	299	59	384	3161	3057	2790

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE PRESENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1890-91. Tons.	1889-90. Tons.	1888-89. Tons.	1887-88. Tons.
German Empire..	1,335,000 ..	1,264,607 ..	990,604 ..	959,166
France	700,000 ..	753,078 ..	466,767 ..	392,824
Austria-Hungary.	760,000 ..	787,989 ..	523,242 ..	428,616
Russia	530,000 ..	456,711 ..	526,387 ..	441,342
Belgium........	200,000 ..	221,480 ..	145,804 ..	140,742
Holland........	65,000 ..	55,813 ..	46,040 ..	39,280
Other Countries..	80,000 ..	80,000 ..	87,000 ..	79,980
	3,670,000	3,619,678	2,785,844	2,481,950

The crop is so far behindhand, as regards the size of the roots, that calculations as to amount of sugar to be expected are still quite problematical. The quality of the roots is tolerably satisfactory, and possibly the production of sugar may not differ much from that of 1890-91.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

Throughout the month of August there has been a tolerably steady business, but the uncertainty still existing with regard to the European beet crop has had a constant effect on the market, and this uncertainty is likely to be maintained until towards the close of September. There has been a good demand for the better kind of cane sugars, prices closing without any material change. Crystallised sorts are firm, the large quantity of Yellow Crystals now produced in this country balances the smallness of the deliveries likely to be made from abroad.

Refined sorts have been in good demand; a distinct advance was established at the beginning of the month, and is maintained. As regards the growing crop of beets, any estimates are still premature. We incline to think, from a comparison of the various reports as to acreage and probable quantity, that the 1891-92 production will be about the same as that of the current year. The steadily increasing American consumption is a factor that must not be left unnoticed. The total imports into the United Kingdom (four principal ports) for 1891 are 55,000 tons in excess of last year for the same period, the deliveries for consumption only 2,500 tons more, and the stocks 5,500 tons less than in the third week of August, 1890.

Present quotations for the standard qualities, as under, are:—

			Last Month.
Floating.			
Porto Rico, fair to good Refining	12/9 to 14/-	against	12/9 to 14/-
Cuba Centrifugals, 97°/o polarization	14/9	,,	14/6
Cuba, fair to good Refining	13/- to 13/6	,,	13/- to 13/6
Java, No. 14 to 15 D.S.	15/3	,,	14/9 to 15/-
British West India, fair brown	12/3	,,	12/3
Bahia, low to middling brown	10/6 to 11/-	,,	10/6 to 11/-
,, Nos. 8 to 9	11/6 to 12/-	,,	11/6 to 12/-
Pernams, regular to superior Americanos..	10/9 to 12/6	,,	10/9 to 12/6
Landed.			
Madras Cane Jaggery..	9/9	,,	9/9
Manila Cebu and Ilo Ilo	9/0 to 9/3	,,	9/3
Paris Loaves, f.o.b...	17/4½	,,	17/- to 17/4½
Russian Crystals, No. 3, c.i.f.	15/3	,,	15/3
Titlers	19/-	,,	18/6
Tate's Cubes..	20/3	,,	20/6
Beet, German and Austrian, 88%, f.o.b. ..	13/5	,,	13/7½

THE

SUGAR CANE.

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All communications to be addressed and all cheques, &c., made payable to "Edward Sutton, Editor of The Sugar Cane, Manchester," which address is sufficient.

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☞ The Editor is not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

We invite the attention of our readers to some interesting figures (see page 511) on the comparative value, as fuel, of megass (from both single and double crushing) and coal, for which we are indebted to the courtesy of Mr. Neville Lubbock.

A paper, by Dr. H. Winter, on the Analysis of Molasses, deserves special notice, and will be found to contain some valuable and novel features. Another, by Mr. Geo. Stade, on the manufacture of rum, contains interesting and useful figures.

The Mauritius Chamber of Agriculture is, we are glad to see, following out the energetic programme laid before it for the session of 1891 by its President, Mr. F. Nash, in his very able address, delivered on the 19th February last. Mr. Nash reviewed in detail the peculiar and extremely varying conditions under which the staple cultivation of the island had been and would have to be carried on, and urged greater attention to improvements in agriculture, the selection of canes, the adoption of more modern systems, and, above all, the use of labour saving implements to grapple with the growing difficulty presented by the labour question. Since then, four of the principal sugar growing estates have authorised Mr. Nash to inform the Secretary of the International Colonial Exhibition that they would offer a prize of Rs.1,000 at the next exhibition for the largest number of plants obtained from seed taken from indigenous cane. Instructions, received from Professor Harrison, of Demerara, relative

to the obtaining and propagation of the seed, have been published and circulated amongst the planters.

At the meeting of the Chamber of Agriculture held July 31st, Mr. Nash delivered an address on the progress of Diffusion in various other sugar-growing countries, promising later on to give some figures relating to the working of that system on the "Britannia" estate. Most of the details given by the President have already been put before our readers, but the *résumé* of the position of diffusion and the mill system which Mr. Nash laid before the Chamber presents some new points, and as we have always wished to afford our readers the fullest opportunity of considering the question of mill-crushing *v.* diffusion, we present the following extract from the address:—

"The system of diffusion has many strong adherents, and also many warm opponents. In the discussion of its merits, its partisans have the advantage of being able to point out, year by year, steady progress in the improvement of apparatus—economy in fuel, and continuously progressive results. On the other hand the system has been examined seriously by some of the leading authorities in the sugar world, and condemned. I am bound to say that when one scrutinizes the objections, it is generally found that, in some particular or another, sufficient data have not been ready to hand, and that consequently some conclusions have been based on assumption. There is too much assumption in matters connected with the sugar industry. On estates where canes are not weighed, it is assumed by managers that their land is yielding 40 or 50 tons of canes per acre; where there is no chemist, it is assumed that the canes yield a miraculous percentage of sugar.

"One critic assumes that all sugar canes, at all events in Mauritius, contain 18 or 20% of sugar, and is surprised that we cannot extract 15% out of canes that contain only 14%. Another takes the working of a battery during its first or tentative year, in Cuba or Demerara, or here at 'Britannia,' and because it only does as well, and no better, than the best system of double crushing and maceration he can lay his eyes upon, he proclaims it a failure; and one gentleman, writing from the other side of the Atlantic, puts down the quantity of coal we are to use at *Britannia* to make 3,000 tons of sugar at 2,250 tons, at a cost in round figures of 180,000 francs. One figure is as arbitrary as the other. I hope that we shall not require so much coal as he anticipates; if we do, it will be our own fault, as the figures I am about to quote from the experience of other countries will show; the price he inflicts upon us, which is just Rs.40 per ton, at an exchange of F. 1·80, is, I can confidently assert, very much higher than we have had to pay last year, delivered at the mill. It must also be remembered that in comparing mill work with diffusion, for the purposes of argument, it is only the very

best mills with the latest improvements which have been taken into account, while what we have to consider in this colony is the advantage that diffusion or any other system may have over the mills as they exist at present here, and whether, in aiming at a higher extraction of sugar, diffusion may or not be the best system to adopt. At present the real crux of the whole matter is the question of fuel, which is indeed a serious one. But before we allow that to frighten us out of a calm consideration of the advantages which are claimed for diffusion, it is as well to remember that a factory making 2,000 tons of sugar, with an extraction of 9% by mill when 12% might be obtained, and sending bagasse containing that 3% of sugar to the furnaces, is really burning 666 tons of sugar to make the 2,000. And 660 tons of sugar, even at our low prices, would go a long way in coal, even at Rs.40 per ton."

A writer in the *Natal Mercury* does not seem to think that the results obtained by the introduction of Indian labour into that colony are so beneficial as they should have been, and he concludes that the remedy for the unsatisfactory position of the industry "will ultimately remain with science and agricultural skill, not cheap labour."

Favourable reports are being received from Queensland and New South Wales, both as to crop and quality of the juice. It is well-known that several of the undertakings in the former colony are under considerable indebtedness to the Government, and the satisfactory season which is now commenced will enable them materially to reduce their debts, which are now somewhat overdue. *The Queenslander* gives the figures of production for the twelve months ending June 30th, 1891, as follows:—"The output of sugar was 69,983½ tons, against 44,411 tons for 1889-90. Our estimate made early in last season was for 65,000 tons, but that anticipation has been exceeded by nearly 5,000 tons. The output, which is within a few tons of 70,000 tons, is the largest yield by fully 10,000 tons for any season since the sugar industry was established in Queensland. Bundaberg, with a return of 23,351½ tons, heads the list for the season, and Mackay comes next with 19,324 tons. The other articles, molasses and rum, also show a considerable increase, but by the sugar increase alone the colony may be said to have profited to the extent of about £307,200 over last year. The yield for 1890-91 was in round numbers 25,600 tons over that for 1889-90, and at £12 per ton the sum mentioned is arrived at."

The abolition of the duties on raw sugar in Canada is attracting much attention in the West Indies, and a revival of the sugar industry in Grenada is being spoken of. The labour question is the main difficulty, but there seems to be a decided objection to coolie immigration. The experience of other islands seems to indicate that no regular supply of other than coolie labour can be looked for, and without a certainty of such regular supply no wise man will undertake the cultivation and production of cane sugar.

We regret to learn that the health of Professor Harrison, the Government Analytical Chemist at Georgetown, has suffered so much from his twelve years' assiduous work in tropical climates that he is compelled to take a rest. Professor Harrison is probably already in this country, and all who know what valuable services he has rendered in the past will sincerely desire his complete restoration, and that he may return to his labours with renewed health and vigour.

The terrible cyclone, the centre of which appears to have traversed the Island of Martinique on the 18th August, has almost utterly devastated the country. The number killed is between 300 to 400, in every direction the stronger buildings were unroofed, and the weaker levelled with the ground, the crop of standing cane being ruined, and many of the smaller sugar works completely destroyed. It is estimated that 15,000 to 18,000 tons of sugar and 4,000,000 to 5,000,000 litres of tafia are lost to the producers. Guadeloupe happily escaped the tornado.

The following is from the *Havana Weekly Report* :—

According to the *Revista de Agricultura*, the calculated increase of 185,000 tons shown by this year's crop over that of 1890 is not altogether a positive one, inasmuch as last year the exportation of molasses added up 115,000 tons, against only 64,000 this year and the difference of 51,000 less this year has remained on a certain number of plantations on which due preparations were made, in time, to boil their molasses and convert it into sugar; after deducting the quantity therefrom obtained, it will be seen that despite the larger extension given last year to cane planting, the increase in the production is not after all so considerable as it appears at first sight.

According to recent calculations published in one of the Havana papers, by Mr. Louis Engel, generally considered as an authority in sugar matters,

it would seem that the diffusion process is not applicable in the Island of Cuba, owing chiefly to the excessive consumption of fuel, even after the American coals are introduced free of duty, inasmuch as on Count Ibanez plantations, for each qtl. of sugar produced by said process during the last crop, there were 200lbs. or a double quantity of coal burnt, and, at an average price of \$8 per ton, the manufacturing of each hhd. of 1,500lbs. of sugar cost \$12 for fuel only.

Besides, if, as stated, the cane juice contained 13½ per cent. of its weight in pure sugar, and the total extraction was only 9·94 per cent. on estate "San Joaquin" and 9·46 per cent. on "Montana," it is evident that 3·54 per cent. and 4·04 per cent. were respectively lost, equivalent to 26·4 per cent. for the first of the above-named estates and 30 per cent. for the second, said figures representing a total loss of 3,790 hhds. of sugar for both plantations, and which have passed nobody knows where, as the statement given to the public by the Fives Lille Co., who set the apparatus, do not say whether said sugar was lost by inversion or remained in the chips.

The possible application of the reciprocity clauses of the McKinley Act in the case of Jamaica is exciting much attention in that island, and this is not to be wondered at when we learn that the abandonment of the present import duties on staple American produce means an immediate loss to the Jamaica revenue of some £60,000.

There seems to be a vague feeling in the United States that Claus Spreckels is in league with the American Sugar Refining Co. (which some papers persist in calling the "Sugar Trust"), and although his action does not, to outsiders, indicate anything but fighting for his own hand, the public appear to think he is something like the "heathen Chinee," that his ways are dark and his tricks past finding out. The "Sugar-King" has lately expressed the opinion that the premiums in the States were working capitally, and that the beet sugar industry could not exist without them, whereas under their protection it is progressing famously.

A newspaper despatch from San Francisco says a new insect has recently made its appearance at Watsonville, where it has attacked beets grown in that vicinity for the sugar factories. It is feared that the ravages of this beet pest will seriously affect the sugar beet industry of the coast, which is just beginning to assume large proportions.

The following is from the *Sugar Bowl*:—Ex-Gov. Warmoth was last week in New York, and is reported as having said: "I believe that our sugar crop will not be as large as estimated. The estimate generally places the crop at 550,000,000 pounds, but I do not think it will be over 400,000,000. The amount of bonus we will receive on the crop, as I estimate it, will be $5,000,000."

Great efforts are being made at Hamburg to induce all the German sugar manufacturers to appoint general agents in that city. This has only partially been the case up to now, whilst Magdeburg is more fortunate in possessing representatives of nearly all the factories. Up to now about one-third of the manufacturers have responded favourably to the request of the Hamburg merchants.

A circular from Mr. F. O. Licht reminds us that on the 12th September, the bureau of statistical information founded by his father completed its 30th year of ultility. We think Mr. Licht is to be congratulated not only on this fact, but on the more important one of the authoritative position which, in spite of much opposition and cavilling, notably on the part of some French manufacturers, he has succeeded in maintaining and strengthening. The study and comparison of the figures of various statisticians for several years has led us to the belief that the Magdeburg reports have been and are, on the whole, the most reliable of all, and fully deserve the estimation in which they are held on this side of the water.

The *Revue Internationale des Falsifications* states that the French Consultative Committee of Hygiene has reported favourably as to the advisability of allowing the manufacture of sacharine.

We should like to call attention to two advertisements which appear in this number of our magazine. "Webster's International Dictionary" has been subjected by us to a searching examination, and we have no hesitation in stating it to be the best of its kind at anything near the price, in fact, a complete cyclopœdia in miniature. Dr. F. G. Wiechmann's book on "Sugar Analysis" was noticed by us in December last, and is all that could be expected from the mature experience obtained by the author in the great Brooklyn refinery of Messrs. Havemeyer and Elders.

COMPARATIVE VALUE AS FUEL OF MEGASS, DOUBLE AND SINGLE CRUSHED.

Assuming the canes to contain 12·5 per cent. woody fibre, and the juice to contain 16 per cent. of sugar; that double crushing expresses 72 per cent. of juice, and single crushing 66 per cent., we shall then find the composition of the megass in each case to be as follows :—

	Double Crushed.		*Single Crushed.*	
Woody fibre..	12·5 = 45	per cent.	12·5 = 37	per cent.
Water	13· = 46	,,	17·5 = 53	,,
Sugar	2·5 = 9	,,	4· = 10	,,
	28· = 100		34· = 100	

In the following calculation the temperature of the gases passing up the chimney is assumed at 450° F., and the quantity of air required for combustion at 24lbs. per lb. carbon, and its temperature at 86° F. The woody fibre is assumed to contain 51 per cent. of carbon, and 1lb. of carbon to give 12,906 units of heat.

Double Crushed Megass.

Composition.. .. 45 parts woody fibre.
46 ,, water.
9 ,, sugar (contains 42·1% carbon).
100

Units of heat .. Woody fibre..	$45 \times {\cdot}51 \times 12{,}906 =$		296,800
Sugar	$9 \times \frac{42{\cdot}1}{100} \times 12{,}906 =$		48,400
Less			345,200
Water to steam ..	$46 \times (212 - 86 + 966) =$	50,200	
Steam	$46 \times (450 - 212) \times {\cdot}475 =$	10,050	
Air for wood..	$45 \times 12{\cdot}25 \times (450 - 86) \times {\cdot}238 =$	47,950	
Air for sugar..	$3{\cdot}8 \times 24 \times (450 - 86) \times {\cdot}238 =$	7,950	
			116,150
Available units..			229,050

Single Crushed Megass.

Composition..	37	parts	woody fibre.
	53	,,	water.
	10	,,	sugar.
	100		

Units of heat ..	Woody fibre ..	$37 \times \cdot 51 \times 12{,}906$ ..	= 243,500
	Sugar	$10 \times \frac{42\cdot 1}{100} \times 12{,}906$ ..	= 54,334
			297,834

Less .. ..

Water to steam..	$53 \times (212 - 86 + 966)$ ..	= 57,876	
Steam	$52 \times (450 - 212) \times \cdot 475$ ..	= 5,878	
Air for wood..	$37 \times 12\cdot 25 \times (450 - 86) \times \cdot 238$	= 40,040	
Air for sugar..	$4\cdot 21 \times 24 \times (450 - 86) \times \cdot 238$	= 8,752	
			112,546
Available units..			185,288

Scotch Coal.

100lbs., according to "Box on Heat," give .. 1,300,600 units.
Less for air.. $100 \times 22\cdot 4 \times (450 - 86) \times \cdot 238$ = 194,055

1,106,545

From these calculations it appears to require—

4·83lbs. double crushed megass.
5·98lbs. single ,, ,,

to give the same amount of available heat as 1lb. of Scotch coal.

One ton of sugar at $8\frac{1}{2}$ rendement gives 4 tons megass.

If 66 per cent. of crushing gives a rendement of $8\frac{1}{2}$ per cent., then 72 per cent., with similar juice, would give $9\frac{1}{4}$ per cent. rendement, and 3 tons megass from 1 ton of sugar.

Assuming Scotch coal to be worth 30s. per ton:

1 ton of double crushed megass is worth 6s. $2\frac{1}{2}$d.
1 ,, single ,, ,, ,, 5s.
4 tons of single crushed are worth 20s.
3 ,, double ,, ,, 18s. $7\frac{1}{2}$d.

100 tons of cane give 28 tons double crushed megass.
,, ,, ,, ,, 34 ,, single ,, ,,

28 tons, at 6s. $2\frac{1}{2}$d. = £8 13s. 9d.
34 ,, ,, 5s. = £8 10s.

N. Lubbock.

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London.

PROGRESS OF THE CANE SUGAR INDUSTRY.

The *Journal des Fabricants de Sucre* of the 16th of September contains an article on the above subject, by Mons. B. Dureau, written with his usual ability and grasp of facts, and we have thought that a translation would be useful to those of our readers who are not conversant with the French language. That the production of cane sugar has not kept pace with that of beet is too well known to most of us; that it has not fallen off is a gratifying proof of the vitality of the industry, and we may be sure that whenever prices shall admit of a rather better profit, the stimulus thus given will quickly result in the more general application to the cane of improved methods of extraction. The only question is whether the increased consumption all over the world, which may certainly be expected, will at all overtake the production. The great increase in the United States in this direction is on a par with the rapid rise in consumption which took place in England along with the abolition of taxation, and we may be quite sure that any fiscal measures in Germany, France, or any other similar European country, which shall bring about a reduction in price, will at once be followed by rapid increase in consumption. The world needs sugar more and more as an essential element of nutrition, an indispensable article of food, and we have by no means reached the possible limit of production either in the case of cane or beet sugar, certainly not as regards the cane. The following is the article in question:—

"The legendary rivalry between cane sugar and beetroot, the contest which exists between these two plants, developing themselves under such different circumstances, has long ago attracted the attention of economists, who frequently ask themselves the question which of the two will be victorious. The statistics show us that the fears entertained with regard to cane sugar were not justified, and that although European beetroot has gained much ground in later years, its foreign rival has never lost but has kept its position, which is being strengthened every year. The total production of cane sugar (leaving out that of the East Indies and the non-exporting countries in general, respecting which we have only insufficient statistics) is at present 2,600,000 tons, against 3,600,000 tons of beet, and some countries, such as Java, Cuba, Louisiana, appear in a position to be able, very shortly, to increase their production in a

considerable proportion. The other countries, such as Brazil, the Philippines, the Sandwich Islands, Central America, South Australia, Texas, Florida, Argentina, Madagascar, and Egypt are also able to cultivate cane sugar with success, and there is no possible doubt that these countries, which are in want of capital or labour, or whose political position is more or less disturbed, possess latent elements of production, which time and circumstances will develope in a greater or lesser degree.

"Amongst the factors of the production of these there is one which was for a long time considered indispensable, without which it was thought impossible to conduct that branch of industry with success. We refer to slavery, which was identified with plantation labour in all the old sugar colonies, the suppression of which, in the opinion of observant men in the past, would bring about a great disturbance of the colonial sugar industry, if not its absolute ruin. The example of our former colony, Haiti, from which the cultivation of the cane, formerly so prosperous, has entirely disappeared, and that of Jamaica and other English West Indian Islands, whose not less celebrated plantations have been to a large extent abandoned since the great Act of Emancipation in 1833, were certainly of a nature calculated to spread this idea, which the decay of the sugar production in Martinique and Guadeloupe after the Revolution of 1848, and the decree of abolition which ensued, has not a little contributed to strengthen. The fact is, that at the time when the political and social events to which we allude took place, slave labour played a preponderating part, and it might be said that the production of cane sugar was exclusively dependent on it. A large number of hands were required for the cultivation of the tropical plant, and the smallness of the quantity of the product obtained therefrom, in works with defective machinery and producing an inferior raw sugar, increased still further the part played by servile labour, which had then no counter-balancing factor in the powerful appliances afterwards supplied by science.

"For a long time, therefore, the word colonist was equivalent to slaveholder, and the party favouring slave labour was sufficiently rich or powerful to have in the Mother Country influential organs of public opinion, which were partisans of this institution. Things have changed considerably since that time. Slavery has been abolished, and the greater portion of the small factories, dating from the time of

Perè Labat, have disappeared, whilst the last cyclone in Martinique must have made an end of the very few which still existed in that unfortunate country. Eighteen large central factories have replaced the hundreds of little estates of the olden time, the only occupation of which now is to supply the raw material for these works, which they can do under such conditions that the cane-grower can obtain a profit equal, if not superior, to that which he realised when he made his own sugar direct. By that division of labour which is a principle of the central factories, and by much improved methods of manufacture, the yield obtained from the cane has been doubled, and the part played by labour as compared with the sugar produced, has been reduced by one-half. In this manner the effect of the abolition of slavery has been successfully dealt with in our colonies, and, with a smaller quantity of cane, the production of sugar has steadily risen above its former level.

"The social position of the large island of Cuba, during the existence of slavery, and notably in the very recent period preceding the gradual abolition of that industry, has been the subject of frequent consideration from an economical point of view. It was generally admitted that the Cuban planters, deprived of slave labour, and without any practical means of replacing it by Indian, African, or Chinese immigration, would have their production diminished to a very great extent, and that a large number of plantations would be given up. Contrary to all expectation, these suppositions have only been partly realised, and though labour has become scarcer and more costly, the Cuban planters have, as a compensation, found means to employ less of it, and to obtain from it better results. A number of small, badly-situated factories, and some whose working was defective, have, as a matter of fact, been demolished or abandoned, but in their place admirably arranged establishments have arisen, and at the present moment the number and magnitude of the sugar undertakings in Cuba is surprising.

"Not that the general production of this fine colony is sensibly increasing. We see, by the statistics last published, that in 1891 it was about the same as in 1873, viz., 750,000 tons, against 775,000 tons, and that it fell off very little in the critical period, 1881 to 1883. But this production, till lately divided among a very large number of proprietors, has acquired an incomparable force of concentration, and central factories are constantly multiplying in all the cultivated parts

of the island. Some of these are stated to be able to work up as much as one hundred million kilos. of cane during the season, and Cuba can now boast of possessing the largest sugar factories in the world. The yield obtained from the cane by the most improved mills, and especially by diffusion, has more than doubled in these works, and the economical result which we pointed out in the case of Martinique and Guadeloupe, that of a reduction in the manual labour per quantity of sugar obtained, has been realised in Cuba on a considerable scale. The scarcity and high price of manual labour are undoubtedly a constant difficulty in Cuba, as in other colonies, but this is no longer an insoluble question, and the system of central factories has rendered it possible to solve it almost completely.

"Louisiana, which up to lately possessed 1,000 to 1,200 small sugar works, which had never, at the time of the greatest prosperity of the State, been able to produce more than 230,000 tons of sugar, is entering resolutely on the same path of progress. Consequent on the war of secession, and the abolition of slavery resulting from it, negro labour became scarce and dear in the whole of the Southern States. But the economic phenomenon which appeared in our Colonies,—the initiative as regards which, we may say, was taken by France—that of a separation between agricultural and manufacturing work, in other words, the system of central factories, this phenomenon has stepped in, and will have the same results as those attained in Cuba. Fifty factories, with superior machinery, located along the great river which traverses Louisiana, or situated in the neighbourhood of railways, will easily do the work of 1,000 or 1,200 small estates of the past time, and will furnish a yield of at least double that which the latter obtained with much difficulty. Slavery has left a gap which can be easily filled up, and free labour, which is that to which the Louisiana planters have since had to look, is proving its superiority every day.

"The economic facts which we have adduced are of prime importance; they mark an interesting phase in the history of the cane sugar industry, which is being regenerated by science and freedom. Much more sugar is being made with a less number of hands, and, thanks to better manufacturing plant, the product of the crops, which up to lately was partly lost through bad appliances, has more than doubled. This constitutes a philosophical triumph, and on this domain the applications of science are in agreement with the principles of humanity."

ANALYSIS OF MOLASSES.

By Dr. H. Winter.

In an examination of the organic acids contained in the cane-juice, formerly undertaken by me,* I had been unable to obtain the quantity requisite for analysis, although the amount of juice used represented the maximum which could be dealt with by the means then at my disposal. I therefore commenced a second examination of a similar character, as it may be assumed that the organic acids of the juice, in so far as they have not been removed in the process of manufacturing, will be found collected in the molasses in the form of their salts.

The examination now about to be described was begun at the "Proefstation Midden-Java" at Semárang; the determination of the acids obtained was made in the laboratory of the Verein für Rübenzucker-Industrie in Berlin.

The molasses used in this examination were the last running from the third jet sugar at the Bendokerep factory, obtained towards the end of the campaign, when only sound and ripe cane was being worked up.

For the first trial 200 gr. of this was dissolved in water, and acetate of lead was added. After the precipitate had been washed for eight days, the water showed no trace of sugar, either by polarisation or with Fehling's solution after inversion; the precipitate was then suspended in water and decomposed with sulphuretted hydrogen.

After the sulphuretted hydrogen had been driven off and the solution had been reduced in volume, the latter was examined in a 400mm. tube by means of the polarimeter. Not the least rotation of the plane of polarisation was indicated, consequently no optically active bodies had been precipitated from the molasses by the acetate of lead.

A further quantity of 500 gr. was used in testing for volatile acids. It was dissolved in water and diluted with the quantity of a tested solution of sulphate of silver calculated to be requisite for precipitating the chlorine. The filtrate, after being acidulated with H_2SO_4 was distilled, and the distillate neutralised with baryta water. The salts of barytes were dried at 110° and boiled down three

* Berichte der Versuchsstation für Zuckerrohr in West Java, herausgegeben von Dr W. Krüger: Part I., p. 36 (Dresden, G. Schönfeld's Verlag).

times with alcohol. In the residuum no nitric or formic acid could be detected.

On the other hand, in the soluble portion of the baryta salts both acetic and butyric acid were unmistakably present. From the residuum remaining after the volatile salts had been distilled off from the acidulated molasses, no lactic acid was obtainable by shaking it up with ether.

Eight kilos. of molasses were used for examination for non-volatile acids in the same way as was formerly done with the juice. After the salts of lead had been decomposed by sulphuretted hydrogen no precipitate was caused by chloride of calcium as above, as the acids forming the not easily soluble salts of lime had been carried off by the lime added in the manipulation of the juice. But on the addition of alcohol, an abundant precipitate of easily soluble lime salts was thrown down. These, being dissolved in hydrochloric acid, and supersaturated with ammonia, gave an abundant and voluminous precipitate A. This was filtered and the filtrate again precipitated with alcohol. No citric acid could be detected in the precipitate; but after acidulation with sulphuric acid and removal of the sulphate of lime by shaking up with ether, another imperfectly crystallised organic acid was obtained. Unfortunately the quantity obtained so diminished in attempting to purify it, that I was compelled to desist from any further attempt at examination.

The precipitate A, probably a basic salt of lime, was also decomposed with diluted sulphuric acid, and after the calcium sulphate had been got rid of, was shaken up with ether. Each time there passed into the ether a small quantity of an acid, which on evaporation remained in the shape of a brownish yellow imperfectly crystallised mass.

Various attempts were made in vain to purify this; finally, by repeated crystallisation with small quantities of water and spreading it on unglazed earthenware plates, we succeeded in getting about three grains of a white powder, consisting of microscopic transparent elongated crystals. This substance is a strong acid. It rapidly expels carbonic acid from carbonates, and dyes the skin yellow if long in contact with it. It is free from nitrogen, does not reduce Fehling's solution, and is optically inactive. On being heated in a glass tube it melts into a brown liquid, which gives a colourless distillate with acid reaction, which does not become solid for some time. On being heated on a platinum plate it burns with a bright flame. It is

easily soluble in water and alcohol, less so in ether. On burning the substance, dried up to 106 degrees, in the oxygen blast we found :—

	I.	II.	III.	Average.	Calculated to $C_{14} H_{16} O_{13}$.
C......	43·09	42·65	42·74	42·83	42·84
H......	3·89	3·99	4·12	4·00	4·08

For the composition of aconitic and fumaric acids, which come nearest to this, are calculated :—

$$\left.\begin{array}{l} C_6 H_6 O_6 \\ \hline C_4 H_4 O_4 \end{array}\right\} \ldots\ldots \begin{array}{l} C = 41{\cdot}38. \\ H = \ 3{\cdot}45. \end{array}$$

As will be shown further on, the behaviour of the salts corresponds with that of no hitherto known acid, thus we really seem to have here a new high-molecular substance. The precipitate A had also been observed under the same conditions in previous examinations of the juice. As according to this the new acid probably occurs in the sugar cane itself, I propose for it the name of

Cannic Acid.

Unfortunately the material at our disposal did not suffice for making experiments for determination of the constitution of the acid, and this must be left to a future time. I will, therefore, only give a description of a few salts.

1. Cannate of Calcium

is produced by saturating an aqueous solution of the acid with precipitated carbonate of lime, and after evaporating the filtered solution, remains in the shape of an amorphous, gum-like, colourless mass. The salt could not be obtained in a crystallised form, either by slow evaporation on a water bath, or in the exsiccator, or by spontaneous evaporation in the air. It dries only in brittle, vitreous masses, which are not hygroscopic, but dissolve slowly in only a small quantity of water.

In the aqueous solution ammonia produces a precipitate, probably in consequence of the formation of the basic salts, which, as above mentioned, was used for production of the acid.

The neutral salt is insoluble in alcohol; it is precipitated by alcohol in snow white voluminous flakes.

The salt dried at 105° showed on analysis a content of 23·43 per cent. Ca., whilst for $C_{14}H_{10}O_{13}Ca_3$ the calculation is 23·52 per cent. Ca.

2. Cannate of Barium

is also only obtained in an amorphous condition. On putting barium carbonate into a diluted aqueous solution of the acid, the whole mass

suddenly stiffens into an immovable jelly, clear as glass,— carbolic acid being rapidly given off. On neutralising the diluted acid solution with baryta water, only a few voluminous flakes of the barium salt are at first precipitated, but in a few moments, especially if gently warmed, the whole contents of the vessel stiffen into a solid bluish-white opalescent mass of jelly, which separates from the sides of the vessel. The formation of such gelatinous lumps took place even when only a half per cent. solution was neutralised. The jelly, when cut in pieces, seems to be slightly soluble in boiling water, but on cooling it does not separate again. On evaporating, there remains behind only a scarcely perceptible membrane, whilst sulphuric acid produces a slight cloudiness in the solution. The amorphous salt is soluble in nitric and hydrochloric acid, and gradually in acetic acid. It is also soluble in cannic acid, no doubt in consequence of the formation of an acid salt.

When the large quantities of absorbed water are driven off, there results a brittle, comminutible powder, which, dried at 150°, gives 52·03 per cent. of barium on being reduced to ashes with concentrated sulphuric acid. For $C_{14}H_{10}O_{13}Ba_3$ the calculation is 51·57 per cent. of Ba. The difference of 0·46 per cent. must be explained by an impurity consisting of $BaCO_3$ as no further purification took place.

3. Cannate of Silver

is obtained in the shape of a white flaky precipitate, by decomposing the aqueous solution of the soda salt with nitrate of silver and alcohol. The dry salt darkens slightly on exposure to light. It is no longer soluble in water, and was purified by washing with a large quantity of water, and afterwards boiling. In spite of careful removal of the nitrate of soda it decomposes, when heated on a tile, with a sort of explosion and development of steam, and leaves behind it a very voluminous mixture of carbon and metallic silver. There was left behind 63·45 per cent. Ag. For $C_{14}H_{10}O_{13}Ag_6$ the calculation is 62·67 per cent. Ag. The difference of 0·78 per cent. is explained by the fact that the soda salt as was ascertained by a subsequent test of the reagents employed, was not free from chlorine.

4. Cannate of Copper.

The aqueous solution of the acid easily dissolves carbonate of copper. It was heated with an excess of this and then filtered. The dark green or bluish solution produced, on cooling, a small quantity of

minute crystals, which under the microscope turned out to be rectangular longish tables of beautiful bluish-green. Cannate of copper is easily soluble in water, but insoluble in alcohol. On being heated the crystals crumble into a green powder; on being calcined they pass into oxide of copper. A quantity of 0·1806 gr., thoroughly dried over sulphuric acid, lost.............. 4·04% H_2O.
On further drying in vacuo at 100° further .... 3·88% ,,

= 7·92% H_2O.

Of the dry salt 0·1662 gr., on being burned and reduced in the hydrogen blast, gave 14·44 per cent. Cu.

The calculations are for—

$C_{14}H_{14}O_{13}Cu + 2\,H_2O$ .... 7·36 per cent. H_2O.
$C_{14}H_{14}O_{13}Cu + H_2O$ .... 3·82 ,, ,,
$C_{14}H_{14}O_{13}Cu$ .... 13·91 ,, Cu.

The fact of the water of crystallisation in the air-dried substance being too high is accounted for by the latter being a little moist. The excess in copper points to a slight impurity.

Unfortunately the material at disposal was insufficient for a repetition of this important analysis.

Finally, small quantities of a platinum salt were obtained, which is easily soluble in water, less easily in diluted alcohol, and insoluble in absolute alcohol. A quantity of 1·22 gr. of the amorphic lime salt was dried, suspended in quite absolute alcohol, and dry HCl introduced, in order, if possible, to obtain a calcium-chloride-diethylether. But no insoluble compound was evolved. The mixture was therefore neutralised with calcium carbonate, and the whole mass boiled several days with acetylchloride. On being poured into water there separated an acethyl compound. But as this was not soluble in any of the usual solvents we had to give up the idea of purifying and analysing it.

Cannic acid differs unmistakably from fumaric acid in its behaviour on being heated. After being heated in the drying stove up to 130° for two hours along with the latter, it did not pass over into evernic acid, which sublimes at 200°. Further, the barytes salt of malic acid is tolerably easily soluble in hot water, and crystallises out on cooling, which is not the case with cannate of barium. Its barium content is also 3% higher than in the last named. Finally, a solution of malate of calcium and ammonia gives no precipitate.

The new acid differs from aconitic acid, first of all in its calcium salt. It never gives, on saturating the solution with calcium car-

bonate and slowly evaporating, that crystallised not easily soluble calcium salt, which is characteristic of the former. This experiment was repeated several times. Of aconitic acid two calcium salts are known, a gum-like amorphous one, $C_6H_4O_6Ca$, which contains 18·87% Ca, and the crystallised $Ca_3(C_6H_3O_6)_2$, with 25·9% Ca.

The amorphous cannate of calcium also contains, as stated above, 23·52% of calcium. Further, aconitic acid gives a crystallised barium salt, Ba $(C_6H_5O_6)_2$, with 28·36% of barium, and a gelatinous one, Ba_3 $(C_6H_3O_6)_2$, with 54·28% of barium, whilst cannate of barium can only be obtained in gelatinous form, and contains 51·57% Ba. The formation and composition of the gelatine of the two salts are clearly different.

Then again the copper salts differ in their behaviour. I have met with no analysis of aconitate of copper, only the statement that it is not easily soluble in water. As a matter of fact, on heating an aqueous solution of aconitic acid with copper carbonate, and filtering, we obtain, after cooling, a small quantity of crystalline salt. The saturated aqueous solution of this is scarcely perceptibly coloured, and the salt dissolves with difficulty. But if a solution of cannic acid is saturated with copper carbonate, the filtrate is of a deep blue-green colour, and, as stated above, does not give up the crystallised salt until it has been evaporated to a small volume. In contra-distinction to aconitate of copper it must be characterised as a decidedly soluble salt.

Finally the solution of aconitate of lime gives no precipitate with ammonia, as the cannate does, the preparation of which, as mentioned above, depends on this.

The analysis of the salts now described does not afford, any more than the elementary analysis, a definite decision with regard to the composition of the cannic acid, but from an examination of the copper salt we may conclude that the formula is not lower than $C_{14}H_{16}O_{13}$. At present no further opinion on the nature of this acid can be expressed, but I hope to have an opportunity, later on, of making decisive experiments.

As regards the practical value of the acid thus discovered, it must, in view of its strongly acid character and its tendency to form salts of a gummy nature, be regarded as a decided agent in forming molasses. At the same time, it should be mentioned that this cannic acid appeared to be present in a relatively larger quantity than the other organic acids in the molasses.

SUGAR CONSUMPTION IN GERMANY.

A well-known trade journal, *Kuhlow's German Trade Review*, has hit upon a novel and very clever means of demonstrating the inaccuracy of the pessimist reports which have been lately circulated in many of the German papers relative to the existence of a state of semi-famine in some parts of the empire. Probably no better indication of the general prosperity of the country will be found than the fact of a steady increase in the consumption of sugar. This, which is in England and the United States a practically indispensable article of food, is by no means so in Germany, where it has not yet emerged from the position of a luxury, and therefore its increased use may well be taken as a proof that things are by no means so bad as they have been represented. We have not space for the whole of the article, but have great pleasure in giving the following extracts:—

"Numberless pens have been employed for some time past in attempting to prove that we are or are not in danger of famine. For some months, according to the showing of some of these well informed people, there has been an enforced economy throughout the whole life of Germany. We consider that there is a point which has been left untouched in the discussion on the height of prices, and that is the development of the whole demand for necessaries, which should be thoroughly observed in order to find a correct judgment of the present state of affairs. We are placed in the enjoyable position of being able to supply general information as to the consumption of sugar, as well as very exact statistics of the amount which is from month to month required, since we are obliged by the present sugar duty, which came into force in the autumn 1888, to pay a duty on every pound of beet sugar manufactured in Germany. Sugar is however a necessity, from the smaller or larger demand for which we are better able to form an opinion than in the case of any other necessary as to whether the people are really suffering under the high prevailing prices. Because sugar, although strictly belonging to the class of necessaries, is still of such a nature that it can be partly laid aside, when it is compulsory for the population to narrow down its requirements, without that any actual suffering ensues. Sugar may be defined as a social barometer, showing when society is in a bad, moderate, or flourishing condition from a pecuniary point of view, and furnishing us with a measure by which to judge of the standard of

life. It will be found by no means uninteresting to-day to follow the demand for sugar during the last few months and to see how the industry has of late developed in the German Empire. We, therefore, insert the monthly requirements in refined sugar in double hundred weights, from January until June of this year, for which the official notices are already published; by this means we shall be enabled to form a fair judgment as to the comparative size of the sugar demand during the first six months of the last three years.

	1891. Double Cwts.	1890. Double Cwts.	1889. Double Cwts.
January	366,117	377,050	288,949
February ..	392,833	385,143	288,462
March	419,536	411,431	370,149
April	358,531	319,055	323,450
May	350,241	346,692	312,518
June	353,981	344,023	281,839

* * * * * *

"The amount of sugar consumed per head throughout the German Empire was reckoned for the first year—namely 1889—at an average 3·9 kg., in 1890 4·4 kg., in 1891, however, at 4·5 kg. The demand for this expensive and somewhat dispensible commodity has increased during the period under discussion. At any rate we are thus furnished with a proof that in the case of a rapidly increasing population the demand per head itself increases so long as the prices are maintained within ordinary bounds, and the consumer is not forced to limit his demand through unnatural causes. So that arguments, declaring that the demands of the poorer part of the population have been already so reduced that they can be reduced no further, are to be refuted by an appeal to these figures which prove that during this year the sugar demand has developed to a greater extent than has been noticeable before. We again repeat that of the articles necessary to existence sugar comes rather far down in the scale; it is, if we may use the expression, a sort of necessary luxury. No one would be able to maintain that if folks had not sufficient money to supply themselves with bread, potatoes, and a piece of meat, that such a necessary as sugar would be as much as thought of.

* * * * * *

"The figures given above concerning the monthly demand for sugar do not exactly represent the real quantity consumed by the

population in a pure form, but they are derived from the only available source, namely, from the manufactories which have the tax to pay, and by this means only can the correct figures be obtained, since to collect statistics from the small dealers would be an impossibility. These figures, however, do represent the quantity of sugar which is therefore consumed at some time, although perhaps not in the month for which these figures are set down. It was very probably the case that in June a certain quantity of the May produce was consumed, so that a proportion of the June produce will be carried forward to the July demand, but if we proceed in this way with the twelve months in the year there will not be very much difference between the amount actually consumed during the same month. After studying actual facts, such as these, no one can credit the announcement that bitter want is prevailing throughout the country when at the same time the consumption of sugar increases month by month."

GERMANY.

Sugar Production in 1890-91.

According to the official Report, the quantity of beets worked up during the campaign, August 1st, 1890, to July 31st, 1891, was 10,623,319 tons (of 100 kilos. = 2,200lbs.), against 2,825,039 tons in 1889-90, and 7,896,503 tons in 1888-89. The sugar produced in three campaigns was:—

	1890-91.	1889-90.	1888-89.
Tons	1,208,470 ..	1,215,386 ..	943,162
Percentage of yield ..	12·05 ..	12·37 ..	11·94

The quantities of sugar obtained from molasses were respectively:—

	1890-91.	1889-90.	1888-89.
Tons	47,851 ..	45,720 ..	44,078
Total production in tons..	1,331,901	1,263,142	989,618

The quantities exported in the twelve months were respectively 735,676, 742,570, and 614,747 tons, for the three campaigns in question; and the quantities consumed in the country, 538,751, 508,000, and 411,927 tons (2,200lbs.).

FRANCE.

Results of the Campaign of 1890-91.

The *Administration des Contributions Indirectes* has just published the definite results of the home campaign of 1890-91. The number of factories at work was 377, of these 233 have adhered to the old regime of "abonnement," 120 availed themselves of the "déchet fixe" of 15°/$_{o}$, and four belong to the category of factories distilling their own produce. The production of these 253 factories amounts to 457, 901 tons, that of the 120 to 157,489 tons, and that of the four distillery-factories to 1,498 tons, making a total of 616,889 tons, (calculated in refined sugar) against 700,409 tons in 1889-90.* The yield (rendement) obtained from the beets, calculated with an estimate of 18,000 tons worked up by the distillery-factories, reached an average of 9½ per cent. in refined sugar, against 10½ per cent. in 1889-90. The yield of the "fabriques abonnées" was 0·79 per cent., that of those accepting the "déchet fixe" 8·85 per cent., and that of the distillery-factories 8·32 per cent. The net *excédants* represent 19·35 per cent. of the total production, against 28·54 per cent. in 1889-90.

The following table gives the results of the last ten campaigns:—

Campaign.	Factories at work.	Production (in Refined). Tons.	Percentage of yield.
1881–82	486	335,575	6·10
1882–83	496	362,737	5·03
1883–84	483	406,007	5·55
1884–85	449	272,962	5·99
1885–86	413	265,084	7·83
1886–87	391	434,043	8·86
1887–88	375	347,785	9·62
1888–89	380	414,869	9·83
1889–90	373	700,409	10·50
1890–91	377	616,889	9·50

The falling off in the yield of sugar per weight of beets is, of course, to be ascribed to the peculiar climatic conditions of last season.

A noteworthy fact in connection with these figures is the *decline* in the exports of sugar from France to foreign countries, which for the first eight months of the year amounts to 32,821 tons "lumps and loaves," 448 tons "crushed, granulated, &c.," and 15,203 tons raw beet, or a total of 48,472 tons, as compared with the first eight months of 1890, the stocks on hand on the 31st August, 1891, being 26,896 tons in excess of those on the same date last year.

* The last estimates were: Licht, 700,000 tons; Deutsche Zuckerindustrie, 685,500 tons; Prager Zuakermarkt, 690,000 tons; which, reduced to refined value, differ very little from the official figures.

PRINCIPAL SUGAR CROPS OF THE WORLD (in tons).

	1891-92.	1990-91.	1889-90.	1888-89.	1887-88.	1886-87.
Cuba	800,000	798,000	645,000	526,000	630,300	610,100
Porto Rico	50,000	35,000	55,000	55,000	60,000	86,000
Trinidad	55,000	48,000	60,000	60,000	60,000	69,000
Barbados	60,000	50,000	85,000	50,000	60,000	65,000
Jamaica	30,000	25,000	25,000	28,000	30,000	21,000
Antigua & St. Kitts	35,000	35,000	30,000	25,000	26,000	25,000
Martinique	30,000	32,000	35,000	38,000	39,000	41,000
Guadeloupe	45,000	48,000	45,000	45,000	50,000	55,000
Demerara	115,000	115,000	120,000	108,000	110,000	135,000
Réunion	35,000	35,000	35,000	25,000	32,000	32,000
Mauritius	125,000	130,000	125,000	132,000	120,000	101,800
Java..............	400,000	414,000	333,000	364,000	396,000	363,900
British India	60,000	60,000	60,000	60,000	55,000	50,000
Manila, Cebu, Iloilo	140,000	140,000	150,000	210,000	174,000	180,000
S. Domingo, Hayti	20,000	16,000	25,000	20,000	20,000	20,000
Pernam., Goianna..	150,000	154,000	110,000	128,000	189,000	146,000
Maceio	40,000	40,000	31,000	44,000	51,000	39,000
Rio Grande........	12,000	12,000	10,000	10,000	12,000	12,000
Maroim, Bahia	15,000	15,000	5,000	10,000	10,000	10,000
Peru	40,000	40,000	30,000	30,000	30,000	26,000
Egypt	40,000	40,000	35,000	35,000	35,000	50,000
Sandwich Islands ..	125,000	125,000	120,000	120,000	100,000	95,000
United States, cane	230,000	225,000	128,000	145,000	158,000	80,000
Total Cane	2,652,000	2,632,000	2,287,000	2,268,000	2,457,300	2,313,700
,, Beet, Europe..	3,700,000	3,670,000(?)	3,627,967	2,785,844	2,431,950	2,750,206
,, ,, U. S. ..	13,000	10,000	....	....	....	....
Cane and Beet	6,365,000	6,312,000	5,914,967	5,053,844	4,949,250	5,063,906

The above figures are taken from Messrs. Willett and Gray's Statistical Journal. While it cannot be denied that any estimate of the coming crops of cane and beet is subject to the great uncertainty which attends all calculations based on that most uncertain of all uncertain things, the weather, still the calculations of these experienced New York statisticians may be taken as having considerable weight. We should incline to regard the quantities for 1891-92 as quite high enough in more than one case.

QUEENSLAND.

The Central Mill System.

The *Queenslander* contains the following extract, which is headed "A Hopeful Outlook." The problem of central factories is apparently being rapidly solved in different parts of the cane-growing countries of the world, and we invite the attention of our readers to the statements in question. Making all allowance for the variety of conditions in the different colonies, it seems to us to be mainly a question of capital, and there is a large amount of this in England which is only seeking for good investment.

"The development of the central mill system at the Colonial Sugar Refining Company's estate at Homebush during the last few months has been simply marvellous. When only a short time ago we notified that the company had decided to give the farmers leases, we observed that very few would realise the importance of the step then taken. It meant that the most advanced sugar making company in the world had decided that a trial was to be given to sugar-growing by white labour, that they were going to separate manufacture from agriculture and inaugurate a new era in the district. But the company has gone much further than we then anticipated. Having decided that they would become purchasers of cane rather than growers on a large scale, they went into the matter with a good will that is certain to make the experiment a success. They are subdividing portions of their immense estate and leasing it to farmers with the right to purchase. The terms are so liberal that already over 1,000 acres of land are taken up, and the applicants for farms are so numerous that the company can pick their tenants. The terms on which the company are dealing with their land are these: There are two documents—a lease, and an agreement for the sale of cane. The land is divided into two classes—bush, which is still in its natural state, and land which has been cleared and cultivated. The leases are for five years, and the rent of the land is 1s. per annum for the first description, and 5s. for the other. If at any time within three years the lessee wishes to become a purchaser he can do so. The price of the land is £1 per acre for bush, and £5 per acre for cultivated land. When the lessee decides to become a purchaser he must pay down one-fifth of the purchase money, and the balance by four equal annual instalments. On this balance interest at the rate of five per cent. is

charged. Rations up to the value of 10s. per week are supplied to the lessee at cost price if he so desires, and the amount is deducted from the value of the cane taken off. In some cases implements and horses are being supplied to the lessee on the same liberal terms. Besides the lease there is an agreement, whereby the tenant agrees to grow a certain quantity of cane, and to deliver it sound and in proper condition on the main tramway line of the company, the company lending portable line to enable the tenants to deliver it. The price paid by the company for the cane is 13s. per ton, but it is understood that when the area under cultivation by the tenants of the company and by the outside farmers supplying the Homebush mill reaches an aggregate of 600 acres, the price will be 13s. 6d., and when the area reaches 900 acres it is to be 14s. This is intended as an encouragement to every one to hit out and get cane in, but if things go on as they are doing now in about two years the larger area will be attained. At Havana for many years attempts have been made to increase the area of cane grown by farmers settled on the estate, and the system is now in full swing there. The farmers on the place will have about 1,000 acres of cane in next year, and this amount will lessen considerably the responsibility of the owners of the plantation. Mr. A. Smith, who has purchased the Victoria mill, is also settling farmers on his land. Altogether, the outlook for the sugar industry is improving. It is developing along the lines we have consistently advocated—namely, *the separation of agriculture from manufacture.* Under these conditions the industry will be more flourishing than ever it was, and more money will be made out of it. Mills will be bigger, and worked cheaper than of old. The mill-owner, having learnt by bitter experience how to manufacture sugar on scientific principles, will make a profit though he pays more for the cane. Some will succumb to circumstances. A mill capable of making 15,000 tons of sugar annually will be established either in town, at the racecourse, or somewhere on the river. The valley of the Pioneer will be occupied by farmers, who will receive from the mill 16s. a ton for their cane. In such a mill, under eight tons of cane will be required for a ton of sugar, which will be turned out ready for market at a cost of less than £8 per ton. This indeed is the future condition of the whole district. Three or four modern mills would clear the whole of the land at present under crop, making a profit, and not a loss. Extension of tramways and light lines by the owners of the mills will bring under the plough all the rich land north

and south of Mackay along the coast, and the population of the district, which now numbers only some 10,000, will in less than ten years be more than doubled. Such is the future before us. Our resources, the climate, the regular rainfall, the opportunities for farmers, have never been advertised to the world, but when they are known, a rush for our sugar lands will be made by the farmers who now earn a precarious living on the Darling Downs and in the Southern colonies. The progress of the district has been considerably hampered by silly people, who have cried, in season and out, 'the sugar industry is ruined.' Their folly now recoils on themselves. They are ruined. One by one they drop out of the community, and a formal word of regret conceals the pleasure felt at their departure. But the sugar industry goes on gathering strength, and increasing year by year, till it eventually attains a position worthy to be compared with the pastoral and mining industries of Queensland.—*Mackay Mercury.*

BEET CULTIVATION IN THE AUSTRO-HUNGARIAN MONARCHY.

(Continued from page 495.)

We are glad to see prominence given in such a publication as the *Royal Agricultural Society's Journal* to the question of beet growing as a matter worth considering by the British farmer. We have already alluded, in our May issue of this year and elsewhere, to the vigorous efforts being put forth to bring this question, in connection with the manufacture of beet sugar in this country, into full notice, and hope some practical and permanent issue may be the result.

Turning to the more voluminous paper by Mr. Hawes, the U.S. Commercial Agent at Reichenberg (Bohemia), we find that he introduces his subject by a reference to the large quantity of sugar molasses and sweets imported during one year (1887-88) into the United States, amounting, in round numbers, to $80,000,000, very pertinently asking why they should pay such a sum for an article that can be produced at home. We do not doubt the feasibility of sugar production, beet as well as cane, in the United States, but we are sure the time is yet distant, when the enormous quantity required for a consumption that is increasing (and likely to increase) at a very rapid rate will be produced in the Union itself.

Mr. Clarke says:—"It has been my aim to make the following report so complete that the practical farmer, as well as the theorist, may become interested in the subject, and find all the details necessary for his information. I have also described briefly the process of manufacture." We find, accordingly, the following headings dealt with in a rapid but very concise style:—Cultivation of the Sugar-Beet; Varieties of Beet; Climate, Soil; Transportation, Market, and Labour; Manuring and Manure; Preparation of the Land, Planting, &c.; Enemies of the Sugar-Beet; Harvesting and Seed Raising. As a good sample of the manner in which each division is treated, we extract the following on

Cultivation.

"From the time of planting up to that of harvesting the following suggestions should be observed: As soon as the sowing is done the roller must be used, because in pressing the surface the humidity, which is very necessary for the process of germinating, is drawn by capillary attraction out of the deeper soil, and the surface is thus kept moist. The roller may be smooth or have rings; the latter is better, because it makes the surface of land rough, and therefore a heavy rain cannot form a crust. If, after sowing, a crust covers the field, the ring-roller is the best implement for breaking it, and after this a light harrow is recommended. Thus is the soil loosened, the air can enter, and germinating and growing are facilitated. When the plants have grown so that the rows are visible, hoeing must be done, and the earlier the better, not only because the weeds are destroyed, but also because the plants need a loosened soil. The oftener the plants are hoed the better will be the crop as regards quantity and quality. Indeed, quantity and a high sugar percentage can only be obtained by hoeing. The first hoeing must be only superficial, that all the weeds are thrown on the surface to dry, and care must be taken that no soil covers the young plants. The hoeing should be done even if the land be dry, as hoeing prevents the evaporation of the water from the deeper soil. If labourers can be had, it is preferable to first hoe by hand in such a way that only the soil about 50 centimetres distant from the beet is hoed and the soil between the rows is untouched. This is then hoed with the cultivator. If hoeing must be done by horse-power, the cultivator is used.

"After the hoeing comes thinning out. This must be done as early as possible, and, generally, plants sowed by the Dippel machine must

be thinned out earlier than those planted by the drill, the reason being that the latter have more light and air than the former. It is practical to thin out when the plants have three or four leaves. The root is then as thick as a straw, and the whole plant has a length of 8 to 10 centimeters.

"If planted with a drill, the work of cultivating can be done in two ways:—

"1. The field is crossed with the cultivator at right angles to the rows, and the knives are set so that they leave about 2·5 centimeters on each side of the beet untouched. Of the plants which remain in this space the weakest are removed by hand.

"2. The whole work is done by hand. By means of hoes the labourers remove the superfluous plants, leaving spaces about 20 to 25 centimeters between. Children are employed here for this work, as they can best get down to it.

"Cutting the leaves off is not sufficient, as the leaves grow again; or, if not, the plant becomes a harbour for insects. One person can thin out one-ninth to one-eighth of an acre a day. After thinning, hoeing by hand should follow immediately to loosen the soil around the plants; then, between the rows should be hoed, and the time this should be done depends upon the weeds and the soil. As a rule, the intervals should not be more than a fortnight. A fourth, and possibly a fifth, hoeing would increase the crop. Of course, hoeing cannot be done when the plants are large enough to be damaged.

"Hilling up now follows. This must be done because, by covering the beets with soil, it prevents the heads from growing out, and therefore this part of the root, which is of no value to the manufacturer, as it contains little sugar, is lessened. Water can run off and evaporate better, and the soil will not become incrusted. In heavy soils this is a very important point. The time for hilling up is important, as if this is done too early the plants are buried, and if too late the leaves are damaged. Hilling up can only be done when the soil is in good condition, *i.e.*, neither too wet nor too dry. For this can be used a plough with a single share. On small farms it is usually done by hand."

To this is added a short paper styled "Hints to American Farmers," by Anton Veith, Professor of the Agricultural College at Reichenberg, who has travelled in the States.

The closing 10 pages are devoted to a description of the manufacture of sugar as carried on in Bohemia, several illustrations and a good large plate of a sugar factory with its accessories being added.

We are inclined, after perusal of these two papers, to think that they contain, between them, almost every item of practical information necessary for those interested in the promotion of sugar-beet cultivation.

SUGAR CONSUMPTION IN INDIA.

The *Prager Zuckermarkt* states that the greatest part of the European sugar sent to India is in transit for the ports of the Persian Gulf, and that the Mauritius product, which is *sweeter than the European kinds*, is used all over India, except Bengal, where sugar is produced. Only when there is a bad crop in Mauritius is European or Hongkong sugar used. For these and other reasons our Prague contemporary concludes that India, and especially Bombay, will never be a regular market for European sugar. We should think it might be worth the while of the Mauritius planters to turn their attention to the Persian Gulf; the quantities which passed through Triest and Bombay for that destination were in 1884, 167,589 cwt.; 1885, 361,484 cwt.; 1886, 69,080 cwt.; 1887, 20,185 cwt.; 1888, 23,442 cwt.; 1889, 78,765 cwt.; 1890, 64,350 cwt. Of the refined sugar imported into Bombay this year, Germany and Bohemia sent 15 per cent.; Mauritius, 60 per cent.; London, Hull, and Antwerp, only 1 per cent.; the total quantity for the five first months of 1891 being 47,500 tons.

Mr. O'Conor's *Annual Review of the Trade of British India* shows a balance of imports over exports of sugar of 1,909,750 cwt., that of the previous year having only been 782,106 cwt. The question is whether this means actually an increase of consumption, because we are not informed whether there has been a decrease of production.

The *Indian Agriculturist* very properly remarks:—"What is clear is, that with the present means of cultivation, the country is unable to produce more sugar at the prices determined by the present foreign competition." We do not for a moment think that anything like the possible limit of production has been attained in a country like India, probably the original habitat of the sugar cane. What is very clear is that we require some more detailed statistics before we can at all assess the real meaning of this great excess of the balance in favour of imports over the preceding year, amounting to over one million cwt.

In connection with this large amount of imported sugar, we are desirous to call very special attention to Mr. O'Conor's remarks. He says:—"Is there any sufficient reason why Madras or Bengal, or Northern India, should not supply the requirements of Bombay in refined sugar? Why should we import any refined sugar from the United Kingdom into Bombay, when we export refined sugar into the United Kingdom from Bengal and Madras? Why also should we export sugar to Ceylon from those Presidencies and receive sugar from Ceylon into Bombay? It would be interesting to learn the causes of these features of the sugar trade in India. If they were known and discussed, they would perhaps disappear, and India cease to be an importer of an article which she produces in abundance herself."

For our part we have been asking ourselves these questions for some time past, and we feel confident the time is approaching when they must be answered. One result only, in our opinion, can be the outcome of proper and intelligent investigation, and that is an ultimate enormous development of the sugar industry in the very quarter which nature has indicated as its appropriate and most favourable location.

We have purposely italicised the remark in the extract from the *Prager Zuckermarkt* in reference to the relatively greater sweetness of the Mauritius sugar. We still hold very firmly to an opinion we have often expressed, to the effect that cane sugar of every kind is really sweeter than beet sugar, and we are not without hopes that some means may be found of demonstrating this, which is as yet only an opinion, to be a fact.

DEMERARA.

According to the Blue Book for 1890 lately published, the following are the figures of Imports and Exports for that year:—

	Imports.				Exports.		
	£	s.	d.		£	s.	d.
United Kingdom	1,129,071	6	8	..	958,873	11	7½
British Colonies	284,754	9	2	..	88,063	15	8½
Foreign Countries	473,292	6	8½	..	1,114,854	8	10
	£1,887,118	2	6½		£2,161,791	16	2

According to the *Demerara Argosy*, the value of the purely Colonial exports was £2,023,301 8s. 1d., and the quantities and values of the staple articles were as under:—

23,115 casks molasses at medium rate of $16·36 per cask.
20,495$\frac{1}{6}$ puns. rum at $51·72 per puncheon.
117,204$\frac{5}{24}$ hhds. sugar at

31,969$\frac{4}{24}$	hhds.	yellow v. p. at	$59·98
69,623$\frac{8}{24}$	,,	refining at	60·82
13,787$\frac{12}{24}$	,,	molasses at	48·00
1,824	,,	muscovado at	46·55
		or an average per hhd. of	58·86
		equal per ton to	65·40

Of the entire shipment of 117,204 hogsheads, 77,359, equal to about 66 per cent., went to the United States, the value being given at £948,618 16s. 6d.

Apropos of the new Canadian Tariff, the same journal remarks:—"Nothing could be more appropriate than a close and friendly relationship in trade between the Dominion and West Indies, and we cannot say that the Canadians have not done something real to bring such a state of things about. The open market (for a year) of the United States, which the Mc.Kinley Bill provided does not seem to have benefited this colony to the extent of a farthing; certainly there has been no increase this year in exports to the States and no increase in the price of sugar. There is no reason therefore in this direction why the Canadian trade should not be fostered, and the best time to begin to do so is at once."

CONSULAR REPORTS.

British North Borneo.

Imports of Sugar for the last six years:—

1885.	1886.	1887.	1888.	1889.	1890.
$	$	$	$	$	$
8,109	14,053	13,143	16,352	29,477	33,275

These are derived mainly from Hong-Kong, Java, and Siam, and the figures show they are steadily growing larger. In the figures of

exports for 1890 there appears, for the first time, an item of $30 for sugar. Up to now, with the exception of tobacco, chiefly "jungle" produce (that which is obtained without artificial cultivation), has been exported. Attention is being turned to coffee, why not to sugar?

Egypt.

The 1889-90 crop of sugar was not a good one. The total yield amounted to 749,692 cantars, of which 129,000 cantars were refined. The yield of the 1890-91 crop, which is not yet finished, is more abundant than has been the case in previous years. The result is partly due to favourable climatic conditions, and also to the newly-adopted system of double pressing. Before pressing the second time steam is forced into the crushed canes, and the juice remaining in them is thus easily extracted.

The rotation system of irrigation has also contributed to this result, as the cultivator is now prevented from overwatering his lands. The Egyptian agriculturist is unable to dispossess himself of the belief that cotton and sugar cannot have too much water.

The area of land planted this year was rather less than was the case last year, but more care and skill were employed in cultivation, and the crop is expected to exceed that of last year by about 250,000 cantars.

(The cantar may be roughly reckoned at 100lbs.).

Japan.

The import into the port of Hiogo is steadily increasing, the figures for 1890, being:—

	Tons.		Value. £
Brown Sugar	6,791	..	69,975
White Sugar..................	19,737	..	350,301
Miscellaneous Sugar	2,046	..	4,971

being an excess of 10,500 tons, value £140,000, over 1889. The refined sugar came entirely from Hong-Kong. The small supply and poor quality of Japanese sugars caused an increased demand for common raw sugar from Java, Manila, &c.

Russia.

The quantities of sugar exported for the last three years are given as follows :—

	1888.		1889.		1890.	
	Poods.	Value. Roubles.	Poods.	Value. Roubles.	Poods.	Value. Roubles.
Sugar Raw	4,121,000	15,911,000	3,426,000	13,369,000	1,540,000	6,269,000
Sugar Refined..	180,000	845,000	112,000	518,000	137,000	634,000

The values are in paper roubles, worth (roughly) 1s. 8d. to 2s. The pood is 36lbs.

ON THE MANUFACTURE OF RUM.

By Geo. Stade, Charlottenburg 2, Berlin.

Up to now very little has been published respecting the working of rum distilleries, and still less has been said with regard to the investigations of the chemist and microscopist into the composition of the products of fermentation, distillation, and rectification.

The following report of some of the latest of these, conducted with the object of clearing up some more or less obscure questions connected with the process of manufacture, &c., may therefore not be without interest to those engaged in the trade who recognise the value of this kind of work in their distilleries. Only those who totally ignore the modern methods of regulating operations in all branches of trade (especially those connected with sugar manufacturing) will doubt the practical value of such work. The class in question are apparently quite satisfied for things to go on in the old-fashioned style, but there can be no doubt that the manufacture of rum conducted on a reasonable basis from the refuse molasses means, in the case of cane sugar, exactly the same thing as the extraction of the remaining sugar from the refuse of the beet sugar factories This should, at all events, be the case in the natural course of things, and it is to be regretted that this branch of the sugar industry has in many places been very much neglected, and that even those who ought to be fully competent in such matters are still going in for the old-fashioned stills and fermenting room, as if no progress had been made in this direction for the last fifty years. The manufacture of spirits from molasses under the control of a scientific employé

by means of modern apparatus will pay just as well as the manufacture of the staple product carried on under similar conditions. Exceptions, in this case, only confirm the rule. Undoubtedly, however, if carelessness, bad air, polluted water, and general filthiness are the order of the day, no care being taken in the manufacture and preservation of the molasses in the boiling house, and it is not thought worth while to exercise any microscopical or chemical supervision—for the alleged reason that the whole management of a distillery is so simple that it may be left in the hands of any overseer or driver—then the very finest distillery plant might be set up and would prove a failure from a financial point of view, even though all the exhaust steam were utilised and the very best rectifying apparatus employed. Under such circumstances it cannot be wondered at the percentage of the theoretical yield—which is and will always remain the only figure for comparison—instead of being 80, or more, goes down to 60, or less, even though the percentage of wash attains a very high (but fallacious) figure, and the yield from the molasses appears to be satisfactory.

The following data are taken from the very best and latest sources. Those most interested in the matter should read the originals, but as the pamphlets in question are not accessible to everyone, the extracts are purposely made sufficiently full to satisfy the most exacting requirements.

Fermentation.

These investigations have only been made in connection with the fermentation of raw cane juice, but they are usefully applicable, under certain reserve, to the working of molasses, &c.

The sediment of wash fermented in a vat is seen, under the microscope, to consist of innumerable cells, smaller in size than those of the common beer-ferment (yeast). They are round and shining, mixed with small granules and separated from one another, not arranged in masses or in form of long bands. Rum-ferment remains unchanged as long as the nutritive matter in which it grows remains the same. If, however, it is put into a liquor containing more sugar than the original wash, or into starch and dextrine solutions, there appears in about 48 hours a dirty kind of mycelium, the threads of which occupy the whole of the liquor. From this mycelium the ferment is easily reproduced, when it is put back into raw juice (ordinary wash).

The mycelium is always present along with the rum-ferment in all fermented wash in the distillery, particularly when fermentation has been going on slowly or the wash has been too much exposed to the air.

The rum-ferment not only differs in structure from the beer-ferment; its products and behaviour are also of a special nature.

1. The rum-ferment has the strongest effect at a temperature of 30° to 35° C.

2. It is very sensitive with regard to cold.

3. At 18° to 20° C. the fermentation slackens, the acidity increases, and the yield of alcohol diminishes.

4. The degree of concentration of the wash has a distinct influence on the vegetation of the ferment.

5. A solution of saccharose of 18 to 19 per cent. appears to give the best yield, of course this means pure sugar, and does not apply to liquids such as molasses.

6. The rum-ferment, both in its proper form and that of mycelium, separates a diastase which converts saccharose into glycose.

Distillation.

The process of distilling may be divided into the following stages:—

1. Long before the fermented wash reaches the boiling point, an evolution of a certain amount of bad smelling gas takes place.

2. Soon after, the first running comes over from the condenser, and consists entirely of methyl alcohol.

3. The pure spirit then comes over in the form of pure ethyl-alcohol.

4. After this the last running appears, having an unpleasant odour due to the presence of a fatty acid which distils over with the last alcohol of low specific gravity.

5. The quantity of alcohol of high degree is not very considerable, as will be seen by the annexed tables.

6. The lees contain no such alcohol.

7. The fatty acid (mentioned in No. 4) is an oil insoluble in water, soluble in alcohol or ether, which in a solution of weak alcohol gives soluble salts with the alkalis. Exactly the same acid can be produced with rum-ferment by fermenting pure candy-sugar solutions, which shows that it does not come from the cane, but is a property of the rum-ferment. It swims on the surface of the wash like oil, and can be separated in order to obtain pure spirit.

8. The lees do not contain glycerine.

9. No succinic acid was found in the lees.

10. Mannite is always present in the lees, in the proportion of about 0·25 per cent. of the fermented glycose.

Analysis of Rum.

The analyses given in the accompanying tables are the result of experiments made with rums coming direct from the country of manufacture. Nos. 1 to 9 were from Jamaica, 10 to 12 from Cuba, and 13 and 14 from British Guiana.

Colour.—The Jamaica samples had a brownish-red colour, the Cuba rums were light yellow.

Taste and Smell.—All the samples possessed the peculiar aroma and taste which is a quality of all genuine rum.

Fusel oil.—No doubt now exists as to the presence of amylalcohol in rum made in ordinary stills. The best methods of determining the fusel oil (amylalcohol) however are by no means reliable as regards rum and arrack, the figures now quoted for fusel oil are therefore given under all reserve as to exact accuracy.

Aldehyd and *furfurol* were likewise present in the samples analysed.

Acids.—All rums are characterised by a greater or less amount of acidity, the acids being partly in a free state and partly in the form of ether.

Both forms were carefully determined, and the figures are very interesting.

Extracts. Sugars. Ashes.

Though pure spirits should not, of course, give any sediment after distillation, it will be found that the analyses show a quantity of dry substances—the residua of the casks, due also to the colouring substances used, such as burnt sugar, &c.

Organic Bases.

Mr. Lindet has shown that much of the rum from the French colonies is very rich in organic bases. In the case of the samples here dealt with, they were not sufficiently large to allow the quantity to be ascertained.

V. Marcano.—Sur la fermentation alcoolique du vésou de la canne à sucre. Comptes rendues de l'Académie des Sciences. 1889, 108 p. 955.

Prof. Dr. Eugen Sell.—Ueber Rum, etc. Arbeiten aus dem Kaiserl. Gesundheitsamte. Vol. vii. 1, 210.

No. of Sample.	Specific Gravity.	Percentage by Volume.	Percentage by Weight.	Fusel Oil. Percentage of Volume.	Fusel Oil. Gr. in 100 ccm.	Ethyl-formate. Gr. in 100 ccm.	Ethyl-acetate. Gr. in 100 ccm.	Ethyl-butyrate Gr. in 100 ccm.
1.. . ..	0·8808	74·30	67·09	0·141	0·114	0·017	0·251	0·005
2..	0·8806	74·04	66·82	0·132	0·107	0·017	0·310	0·006
3..	0·8809	74·44	67·25	0·106	0·086	0·019	0·612	0·008
4..	0·8789	74·65	67·47	0·058	0·047	0·015	0·502	0·0023
5..	0·8665	79·06	72·46	0·106	0·086	0·022	0·405	0·0062
6..	0·8760	75·89	68·87	0·045	0·036	0·019	0·428	0·0064
7..	0·8785	74·91	67·77	0·104	0·084	0·014	0·472	0·0073
8..	0·8721	77·04	70·15	0·122	0·099	0·014	0·426	0·0164
9..	0·8783	75·04	67·92	0·037	0·030	0·017	0·542	0·011
10..	0·8780	74·74	67·58	0·140	0·114	0·014	0·511	0·005
11..	0·8793	73·73	66·48	0·115	0·093	0·010	0·092	0·103
12..	0·8756	75·29	68·19	0·074	0·060	0·008	0·363	tracē
13..	0·8792	74·72	67·56	0·113	0·092	0·018	0·297	0·006
14.. . .	0·8776	75·21	68·10	0·101	0·082	0·023	0·179	0·0063

No. of Sample.	Ethyl-caprate Gr. in 100 ccm.	Free Formic Acid. Gr. in 100 ccm.	Free Acetic Acid. Gr. in 100 ccm.	Free Butyric Acid. Gr. in 100 ccm.	Free Capric Acid. Gr. in 100 ccm.	Extract. Gr. in 100 ccm.	Ash. Gr. in 100 ccm.	Glucose. Gr. in 100 ccm.	Saccharose. Gr. in 100 ccm.
1..	0·012	0·009	0·072	0·004	0·005	0·536	0·010	0·199	0·087
2..	0·009	0·007	0·078	0·003	0·004	0·423	0·007	0·104	0·0167
3..	0·027	0·009	0·091	0·004	0·011	0·704	0·0013	0·2653	0·0969
4..	0·012	0·007	0·068	0·005	0·008	0·6868	0·0088	0·2704	0·0758
5..	0·008	0·004	0·047	0·002	0·005	0·7820	0·0104	0·2160	0·2398
6..	0·009	0·003	0·058	0·003	0·004	0·8420	0·0164	0·406	0·141
7..	0·008	0·008	0·059	0·007	0·005	0·5548	0·0116	0·254	0·098
8..	0·0223	0·007	0·055	0·009	0·012	0·2700	0·0036	0·0364	0·0832
9..	0·013	0·009	0·081	0·007	0·007	0·3908	0·0076	0·176	0·064
10..	0·008	0·012	0·105	0·003	0·003	0·063	0·004	0·0000	0·000
11..	0·006	0·006	0·056	0·011	0·004	0·0296	0·0024	0·0000	0·000
12..	0·005	0·003	0·078	trace	0·005	0·0460	0·0036	trace	trace
13..	0·009	0·012	0·072	0·007	0·004	0·549	0·020	0·1684	0·0213
14..	0·016	0·011	0·065	0·009	0·005	0·6976	0·0348	0·260	0·082

NOTICES OF BOOKS.

A Historical Geography of the British Colonies.

There has lately issued from the Clarendon press a series of books, bearing the above title, by Mr. C. P. Lucas, B.A., of Balliol College, Oxford, and the Colonial Office, London. We have now before us Vol. II. of the series (which commenced to appear in 1887), dealing with the British West Indies, including Guiana. The statistical parts are stated by the author to have been written mainly by Mr. Harris, of the Colonial Office, Secretary to the late Royal Commission to the West Indies, and as Mr. Lucas, in his connection with the Colonial Office, has full access to the considerable number of valuable works preserved there, and has also been assisted by reference to the Public Records, and by gentlemen having special local knowledge, we have now before us, in a readable compass of some 330 pages, what is probably the most reliable short account of the British West Indian Colonies which has hitherto appeared. The author has wisely avoided encumbering his pages, as is too often done, with a mass of lengthy extracts, and contented himself with condensing and putting into a connected historical form the contents of many tiresome documents and publications, dating from a period when time was not so valuable as it now is, and the daily reading of some half-dozen journals had not become a dire necessity to all who wished to be well informed. For this service, Mr. Lucas deserves the hearty thanks of everyone whose duty or pleasure it is to be acquainted with the history of our West Indian Colonies. The whole book is exceedingly interesting, not the least so being Chapter I. of Section II., which consists of over forty pages, devoted to the history of European colonisation of the West Indies. As a sample of the succinct style of the author, we will select the portion on Barbados, and proceed to give some extracts, but we think no one who aims at possessing a library, even in the most restricted sense of the word, should be without the books of this series:—

"Barbados is said to have been so called after the bearded fig trees found on the island by its first discoverers. The Portuguese are reputed to have first discovered it early in the sixteenth century; and lying, as the island does, outside and to the east of all the West Indies, it may well have been visited by them on their voyages to and from Brazil. They left no traces, however, of their visits beyond

the name and a stock of pigs; and though the Spaniards are said to have carried off the native inhabitants to slavery in their mines, Barbados has no history before the English landed there, finding the island, in Burke's words, 'the most savage and destitute that can well be imagined,' and without 'the least appearance of ever having been peopled, even by savages.'

* * * * * * *

"In 1605, the 'Olive Blossom' was fitted out by Sir Olave Leigh, 'a worshipful knight of Kent,' with stores and settlers for his brother's colony in Guiana. The ship touched at Barbados, and the sailors, finding the island unoccupied, set up a cross near the spot where Jamestown, now Holetown, was afterwards built, and left the inscription 'James, K. of E. and of this island.' In this wise Barbados was first claimed as British territory. No settlement, however, was made at the time or for some twenty years afterwards, till good reports of the island attracted the attention of a rich London merchant, Sir William Courten.

"Courten, the founder of the British colony of Barbados, was of Dutch or Flemish extraction.

"He heard of Barbados from his Dutch correspondent, and, in 1624, one of his own ships returning from Brazil was driven by stress of weather to touch at its shores. So bright were the accounts which he received, that he determined to send out settlers; and at the end of 1624, or the beginning of 1625, his ship the 'William and John,' commanded by Captain Henry Powell, arrived at the island with forty emigrants on board, one of whom was the son of John Winthrop, afterwards Governor of Massachusetts. The colonists established themselves near where the men of the 'Olive Blossom' had landed; and, in calling their little settlement Jamestown, they seem to have marked the fact that the colonisation of Barbados dates from the reign of James the First."

"While the ownership of Barbados was still in dispute, Courten, as has been seen, had begun to colonise it. Patronised at first by the Earl of Marlborough, he subsequently secured the protection of Lord Montgomery, who, in obtaining a grant of the island, really obtained it in trust for Courten; and Courten therefore came into conflict with the rights and claims of Lord Carlisle."

"Thus, for more than a year, there were two opposite camps in the island, with rival governors, at times in open warfare with each

other, and it was not till the end of 1629 that the Leeward men were overpowered, Lord Carlisle's authority fully recognised, and Courten's and Lord Montgomery's interest in the island finally swept away."

A good sample of the documents which have formed to some extent the basis of Mr. Lucas's work will be found in our remarks further on, on the current number of "Timehri." It relates to the adventure of Sir William Courten, or Courteen, referred to in the above extracts.

TIMEHRI: Being the journal of the Royal Agricultural and Commercial Society of British Guiana. Volume V., New Series, Part I.

It scarcely seems six months since we had the pleasure of receiving and mentioning (see *Sugar Cane* for April, 1891,) the second part of Volume IV., New Series, of the above interesting journal. The present number seems to us even more interesting than the last, and amongst the most valuable papers which it contains are the Rattlesnake—The Growth of the Rattle, by the Editor; The Berbice Industrial Exhibition; The Minor Industries in Trinidad and Tobago; The Coins of British Guiana; and Papers relating to the early History of Barbados. From the latter we extract the sworn examination of Thomas Parris, to be found among the MSS. of Trinity College, Dublin, which, along with others given in the present number of *Timehri*, throws much light on the doings of the first colonists of the island. The extract is the more interesting as we believe there are descendants of the Thomas Parris in question still living in Barbados. The following is the paper alluded to:—

THOMAS PARRIS, HIS EXAMINATION.

THOMAS PARRIS, of London, merchant, sworne and Examined the 16th day of March, 1656, upon his oath saith that, in or aboute the moneth of July, 1620, this Deponent arrived in the Iland of the Barbadoes in a shipp called the *Long and Costly*, one Irish, Commander, in which said Iland one POWELL, being then and there, had planted two plantacions, the one called the Corne Plantation and the other called the fforte Plantacion, and the said Plantacions being settled by the said POWELL, as Agent for Sir WILLIAM COURTEEN, Knt., and one Mr. MONSE, as this Deponent then heard. And this Deponent further saith that one Captaine CHARLES WOLVERSTON arriving in Barbados aforesaid did assume unto himself to bee

Governor, under pretence of the Earl of Carlile, of the said Iland, and then tooke Captaine John Powell, this Deponent, and severall others, Prisoners, and put them in Prison, and took the said fforte, and the Goverment of the said Iland to himselfe under the said Earl of Carlile, and that (sic), in or aboute the yeare 1629, one Captaine Henry Powell arrived in the said Iland with a Commission from the Earl of Pembrocke, then Lord Chamberlaine, to make the said John Powell then Governor of the said Iland; and, finding the said John Powell, this Deponent, and others, imprisoned as aforesaid, the said John Powell, this Deponent, and others, went aboard the said Henry Powell's shipp, and landed the said Henry Powell's men in the said Iland, who found the said Wolverston and one Deane and others in the said fforte, took them Prisoners, and sent them away Prisoners in a shipp from the said Iland; and that, by vertue of the said Commission from the said Earl of Pembrocke, graunted him from the then King Charles, under the greate seale of England, the said Henry Powell settled the said John Powell Governor of the said Iland. And this Deponent further saith that that six monethes after, or thereabouts, one Henry Hawley arrived in the said Iland in a shipp called the *Carlile* with several men, with a power from the said Earl of Carlile; but the said Hawley had not admittance to land in the said Iland as Governor for Carlile; and afterwards there was a Parly between the said Governor John Powell and his Councell and the said Henry Hawley, and after the said Parly the said Hawley invited the said John Powell and others to an entertainment aboard the said ship, and, when they were there, the said Hawley took them Prisoners and carried the said John Powell and others from the said Iland of Barbadoes, and thereupon the said Iland was settled for the use of the said Earl of Carlile by the said Henry Hawley. Thomas Parris.

Histoire de la Legislation des Sucres (1664-1891), suivie d'un resumé général des lois et des règlements en vigueur, d'annexes, de tableaux statistiques et d'une table chronologique et analytique des lois, règlements et décrets depuis l'origine. Par E. Boizard et H. Tardieu.*

The title of the above work speaks for itself, and when we add that M. E. Boizard is the Chef de Bureau of the French Treasury Office,

*Paris: Bureaux de la "Sucrerie Indigène et Coloniale;" 10, Rue de Louvois, 1891.

and was the Secretary at the London Internation Conference, and that M. H. Tardieu is the manager of the *Sucrerie Indigène et Coloniale* and has occupied distinguished positions in connection with the Comité Central des Fabricants de Sucre, and the Association des Chimistes de Sucrerie, we have stated what is a sufficient warrant for ability and knowledge of sugar matters to enable our readers to feel certain that the subject of this valuable publication, of nearly 400 pages quarto, has been properly handled.

The book is absolutely indispensable for those who would become acquainted with the history of sugar legislation in France. In glancing through its well-printed and carefully arranged pages, we cannot help feeling deeply thankful that legislation so remarkable for constant change and the frequent and most irksome pressure which it must inevitably have exercised on the sound development of industrial and agricultural production is, in this favoured country, a thing of the past. Other countries than England are in a better position to derive instruction and profit from the mass of facts which this volume so clearly supplies, and when we learn, that in 1839 there were already 547 beet sugar factories at work in France, every convinced free-trader must have presented to him the thought of what a good and sound self-supporting industry this might have become, had it not been too long rocked in the nursing arms of State support and protection, till it seems finally almost unable to stand without them. Up to now, no such succinct and complete work on the subject as the present publication has existed, and, as far as we are able to judge, fully justifies the expectations we were entitled to form from the high ability and distinguished position of the authors.

The Swenson Patent System of Evaporator.

We have received a remarkably neat and elegant little pamphlet, bearing the above title, and forming a complete handbook descriptive of the various machinery, such as triple effects, diffusion batteries, cane cutters and comminutors, and filter presses, but especially the *Swenson Patent Evaporator*, which are manufactured by the important firm known as the Fort Scott Foundry and Machine Works, at Fort Scott (Kansas). This firm has had great and phenomenal success with the system of evaporators known as "Swenson's Patent" chiefly in Louisiana and Texas, but also in the Hawaiian Islands. For one

of the large factories in the latter country the Fort Scott Company have now in hand an order for a Quadruple Effect, to produce an actual evaporation of 165,000 gallons in twenty-four hours. The little handbook is illustrated with remarkably clear and well executed engravings.

☞ Want of space compels us to defer until next month a notice of several interesting and valuable books of reference, notably "*King's Handbook of the United States*," published by the Moses King Corporation, Buffalo, N.Y., which we advise all our readers who are interested in American affairs to procure at once.

Correspondence.

THE LABOUR QUESTION.

Letter addressed to W. H. Jones, Esq., London, by a Planter, residing in California:—

Mr. W. H. Jones, Upper Norwood.

Dear Sir,—In looking over some back numbers of *The Sugar Cane* I came across a letter of yours anent Barbados.

In it you speak of possible labour difficulties. Having a plantation myself (turning out about 1,800 tons per season) in the Pacific, I, too, am forced to consider these matters, and have an idea that a system of co-operation can be introduced that will do away with much of the friction. What could a Barbadian labourer cultivate annually, land, implements, and cattle (with feed) supplied free of charge, and what could he afford to sell his cane for?

We get about three tons per acre of plant, and about half that quantity of ratoon; labour \$15 to \$17 per month.

Trusting you will excuse the liberty I take in addressing you,

I am, dear Sir,

Yours truly,

(Reply.)

Dear Sir,—I have to acknowledge the receipt of your letter of the 21st July, referring to a letter of mine in one of the back numbers of the *Sugar Cane*. I hope what I may write may be of service to you, although it may not be quite on the lines indicated in your letter. There can be no doubt that one of the problems of the age is how to reconcile capital and labour. At present, I think labour has the worst of it, and yet labour is the foundation of all wealth, for both land and capital are valueless without it.

If I had a farm or sugar estate of my own I should adopt the following plan to secure a complete reconciliation of capital with labour. I should call my labourers together. I should name the value of the farm or sugar estate. Let the value, say, be £30,000. Upon this sum I should point out I expected an interest of 5 per cent. per annum. I should then tell my labourers that as their labour was their capital it also was entitled to 5 per cent. interest, which I was prepared to pay them at the end of every six months. I should have a pass book for every labourer, in which should be entered his weekly earned wages. The aggregate of these weekly wages at the end of six months should be increased by the 5 per cent. interest. I should point out that I considered my time in managing the whole concern was worth £500 per annum, on which, as it was my labour, I was entitled to 5 per cent. per annum. I should then state to them that I was prepared, after making these several deductions, to divide with them, in proportion to our several earnings, the profit made by our combined capital and labour.

I hope this rough outline may be of service to you. I think this is a better plan than buying the canes from the labourers. In Barbados the canes cut every year, plants and ratoons, are about 35,000 acres. In 1890 the crop was 85,300 hhds., about 16 cwt. net, per hhd. That was an exceptional crop. The average has hitherto been about 50,000 hhds. This average, owing to improved machinery and higher farming, will doubtless be increased in future years. I shall be glad to hear what you think of my proposal.

I am, dear Sir,

Yours faithfully,

W. H. Jones.

2, Vermont Road, Upper Norwood, S.E.,

20th August, 1891.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; 63, Long Row, Nottingham; and 323, High Holborn, London.

ENGLISH.

APPLICATIONS.

11874. Robert Harvey, Glasgow. *Improvements in and relating to the manufacture of sugar, and an apparatus therefor or connected therewith.* 13th July, 1891.

11999. C. H., F. L., and R. L. Roeckner, London. *Improved means and apparatus for clarifying and purifying liquids.* 15th July, 1891.

12054. Herman Klein and Georges Dethan, London. *Improvements in apparatus for automatically manufacturing cold syrups of a determined density.* (Complete Specification.) 15th July, 1891.

12058. R. F. Cordero, London. *Improvements in apparatus for defecating and evaporating saccharine juices.* (Complete Specification.) 15th July, 1891.

12021. S. E. Ball, London. *An improved sweet mould.* 15th July, 1891.

12316. R. Heaton, London. *Improvements in filter plates.* 20th July, 1891.

12355. O. Mengelbier, London. *An improved apparatus for sucking off the green syrup from sugar masses, and purifying the latter.* 21st July, 1891.

12518. C. Ferguson, London. *Improvements in the manufacture or refining of sugar.* 23rd July, 1891.

12520. C. Ferguson, London. *Improvements in the manufacture or refining of sugar.* 23rd July, 1891.

12808. R. F. Cordero, London. *Improvements in apparatus for washing sugar.* (Complete Specification.) 28th July, 1891.

13222. E. Freund, of the firm of T. Raaschou & Co., London. *Improvements in filtering apparatus.* 5th August, 1891.

13260. T. Drost, Breslau. *Improvements in the process and means for manufacturing crystallised sugar in refineries.* 5th August, 1891.

13875. E. Casper and W. Sowerby, London. *Improvements in drying moulds.* 17th August, 1891.

13931. J. E. Bott, London. *Improvements in or connected with steam boilers, and other evaporating apparatus.* 18th August, 1891.

14424. Charles Mc.Neil, junr., Glasgow. *Improvements in the construction of the checks of sugar mills and other rolling mills.* 26th August, 1891.

14563. George Fletcher, London. *Improvements in or connected with cane-crushing mills.* 28th August, 1891.

14575. August Schneller & William John Wisse, London. *Improvements in the refining of sugar juice or molasses.* 28th August, 1891.

ABRIDGMENTS.

13322. Richard Harburn, Sunderland. *Improved apparatus for evaporating and distilling liquids.* 25th August, 1890. Liquids are evaporated and distilled by the aid of steam in chambers. The steam and liquid are brought in contact in a mixing apparatus immediately before entering the evaporating chamber. In the latter plates are placed for intercepting matter not intended for evaporation, which is then carried away by pumps. The evaporated part is conveyed to suitable condensers. The baffle plates may be perforated or otherwise, and are so fixed as to be easily removed for cleaning.

8809. Wm. Julius Mirrlees, Glasgow. (A communication from Homer Taylor Yaryau, of Toledo, Ohio, U.S.A.) *Improvements in evaporating and distilling apparatus.* 23rd May, 1891. This relates to evaporating apparatus of the kind described in his previous patents, No. 14162, 1886; and 213, 1888. In order to obviate the loss of heating efficiency caused by the increase in the diameter of the tubes of the heating coil to correspond to the increasing volume of the contents as the evaporation proceeds, the tubes constituting the coil are divided into any desired number of rows, the number of tubes in which is increased from the first to the last row. The connection between the rows of tubes at both ends are preferably made by return bend heads provided with horizontal partitions forming cells substantially, as described in patent No. 213, 1888. After passing through the various cells and tubes of the heating chamber, the liquid and vapour are delivered to a separating chamber.

7187. Samuel Morris Lillie, of Philadelphia, Penn., U.S.A. *Improvements in evaporating apparatus.* 25th April, 1891. This related to in transit evaporating apparatus, viz., apparatus in which the evaporation is effected from a liquid while flowing in thin sheets over the heated surfaces. It consists as regards a single pan, of a

battery of horizontal evaporating tubes contained in a chamber, which are closed at their ends fronting one end of the chamber, and at their other ends connected with a steam supply conduit. A spraying device is placed above the tubes, and the liquid to be evaporated is thereby distributed over the tubes and falls to the floor. Escapes are provided for the vapour evolved and the concentrated liquid.

7704. Hugh Burgess, Rayer's Ford, Penn.; and Charles D. Davies, Washington, both U.S.A. *Vacuum evaporating apparatus.* 4th May, 1891. This invention refers particularly to that class of evaporating apparatus wherein a series of pans are supported one above the other in a vacuum chamber, the liquor passing in a continuous stream through them in succession over the heated bottoms of the vessels alternately, in opposite directions; the residuum being discharged through an outlet at the bottom of the vacuum chamber, while the vapour is drawn off from the top of the apparatus. The special object of the invention is to provide a simple means whereby the vapour produced will not only be heated to a much higher temperature, but will also be materially increased in quantity without increasing the size and cost of the apparatus. The liquor is fed to the upper pan by means of a valved pipe. Unevaporated liquor may be discharged into the next pan. The heating may be done by a steam or hot air coil. Above the level of the liquid a superheating coil is placed in close proximity thereto, whereby the rising vapour may be superheated and the quantity thereby increased.

9665. Ernst. Buescher, Helmstedt, Germany. *A process for separating impure sugar masses in one operation into crystallized sugar and molasses, avoiding all after products.* 8th June, 1891. This object is attained by boiling the saccharine juice to produce grain, and treating the mass so produced in a peculiar manner, by which the grain sugar will be separated from the mother liquor without a further addition. The preparation of the mass must be so carefully observed that the proportion of three parts of non-saccharine matter to two parts water is maintained. The prepared mass is filled out of the vacuum apparatus in thin layers so called. Schützenbach or other boxes may be employed. These vessels must be of such height that the layer of sugar mass is not more than six inches thick, otherwise the formation of the molasses will not be satisfactory. The contents of the vessel ought to be limited to 24 to 30 pounds. The use of shallow vessels is calculated to prevent the crystals or grains in

the mass from being deposited at the bottom of the vessel. The vessels are allowed to cool gradually at ordinary temperature for about forty-eight hours. During this time the entire crystallizable sugar separates out of the mother liquor. It is then treated in a centrifugal machine without being reduced or mashed if small boxes are used, whilst the sugar mass produced in larger vessels is preferably mashed before being treated in the centrifugal machine. Separation is facilitated by the employment of rapid operating machines.

10331. Adolphe Lefranc, of Flavy-le-Martel; Louis Lefranc, of Tracy-le-vol; and Armand Vivien, of St. Quentin, all in France. *Improvements in and connected with the manufacture of sugar.* 3rd July, 1890. The invention relates to the agents, and the method of their employment, used for eliminating the organic and mineral impurities in sugar extraction; fluosilicates of the metals are employed for the purpose, the fluosilicates being preferably those of lead and iron in the condition of acid salts; and when used they are caused to act on the sugar in an acid condition or in an acid medium.

13284. James Foster, of Baltic Chambers, Sunderland. *Improvements in and relating to evaporating apparatus.* 23rd August, 1890. Several sets of vertical tubes are provided in each effect, and occupy the lower half thereof. These tubes contain the liquor under treatment, and they are supported top and bottom in tube plates. The tube plates have a number of division strips, which form a series of channels. The only communication between the channels is by means of the tubes, and the liquor is thus caused to follow a circuitous path through the vessel. The outer surfaces of the tubes are heated with steam or the vapour arising from a former effect; the said vapour being collected from the space above the channels above mentioned.

15698. Robert A. Robertson, of the firm of Mirrlees Watson and Yaryan Co., Engineers; and David Ballingall, Manager, of 45, Scotland Street, Glasgow, N.B. *Improvements in apparatus for evaporating, concentrating, and distilling liquids.* 4th October, 1890. This invention comprises the addition to each vessel of a multiple effect of a second smaller heating surface, over which the feed is caused to flow in a direction contrary to that of the main body, and thus receive a preliminary heating.

AMERICAN.—ABRIDGMENTS.

456654. Christen John Jeppesen, Chicago, Ill., U.S. *Centrifugal machine.* 28th July, 1891. This is a ball device applied to the top of the vertical shaft of a centrifugal machine, for supporting and

allowing the basket to rock thereon. The top of the shaft is globe-shaped, with a hollow in which rests a ball; the ball has a tongue and groove; the tongue takes into a recess in the hollow of the globe, while into the groove a tongue on the underside of the recessed bottom of the basket enters.

457097. Lorin R. Tabor, of Westford, Vt. *Process of evaporating syrup.* 4th August, 1891. This invention relates more particularly to evaporating maple sap, where malate of lime is deposited, which is removed by reversing the flow of the raw sap in the evaporator.

457234. Magnus Swenson, of Fort Scott, Kansas. *Evaporator.* 4th August, 1891. The object of this invention is to prevent the escape of foam with the vapour in vacuum evaporators. This is done mainly by a separator consisting of a series of annular drums communicating one with another, each having an inlet and outlet with interposed partition.

455308. Ramon. F. Cordero, of Rubio, Venezuela. *Apparatus for defecating and evaporating saccharine juices.* 7th July, 1891. This invention consists in arranging the cleaning pans directly over the furnace, which latter has an outlet and a return flue, with another pan having a longitudinal partition forming a return channel in vertical alignment with the flue, and having an outlet at the end over the flue outlet, in combination with valve waste pipes, scum-chute, outlet pipes, and receptacle.

456799. Ramon. F. Cordero, of Rubio, Venezuela. *Apparatus for washing sugar.* 28th July, 1891. This relates to the washing of sugar by alcohol, and consists in apparatus of special construction for circulating the alcohol so as to cause it to wash successive charges of sugar with little waste. The apparatus consists of a closed sugar receiving vessel through which, when filled, alcohol is passed under the suction of an air pump, having a detector and trap for freeing the air from alcohol, an alcohol-supply receptacle having a valved connection with the upper end of the said cone, an outlet therefrom provided with a glass section, a boiler, an alcohol condensing apparatus above the boiler, and vapour pipe leading to it from the boiler, together with suitable traps, worms, and pipes leading to the alcohol tank.

GERMAN.—Abridgments.

55037. R. Folsche, Halle-on-the-Saale. *Improvements in centrifugals with case pipes, whereby they may be adapted for use as cover centrifugals for sugar and the like.* 17th March, 1889. The centrifugal

drum, with case pipes, usually employed for separating liquids of different specific gravity, is provided in its interior with a perforated drum and a separating or sifting disc. In order to wash out the masse cuite, the adhering mother lye or mash liquor is first centrifugalled off, the case pipes removed, and the mass thoroughly impregnated with the washing-out liquid, which latter is then discharged through one of the movable case pipes. The inner case pipe is made use of if the washing-out liquid becomes, during the process, specifically lighter. After the liquid is entirely discharged by means of a pipe or other discharge arrangement, the sugar is centrifugalled until dry.

55253. F. May, Hatschein, near Olmütz, Moravia. *Improved apparatus for the production of cube sugar.* 20th March, 1890. The apparatus consists of a movable stand with a trough-shaped floor, support frames for four columnar moulds, and a central perpendicular broad pipe serving for the introduction of the masse cuite, which enters by means of openings and spaces in the floor from underneath into the moulding columns, rising in the same and forcing the air without leaving bubbles behind out of the pillars. If simultaneously with cube sugar, sugar in the form of blocks or plates is also required, an empty frame is inserted between every two frames filled with sheet metal moulds.

55257. L. Sindelar, Mlynóu, Russian Poland. *Improved filter, with wedge-shaped filter packets for sugar juices and other liquids.* 7th May, 1890. The filter is formed of a row of wedge-shaped filter pockets, arranged side by side, each of which consists of a flat head piece, provided with discharge conduits, of a band fastened thereto and of a bag of filter cloth closely surrounding both of the latter. The bag is held apart by wires stretched between the head piece and band, and is in the form of a wedge. This enables the filter surfaces to serve as filtering mediums for a longer period, as the coarser filtrate in consequence of its weight again falls off from these filter surfaces.

IMPORTS AND EXPORTS (UNITED KINGDOM) OF RAW AND REFINED SUGARS.

JANUARY 1ST TO AUGUST 31ST.

Board of Trade Returns.

IMPORTS.

Raw Sugars.	Quantities.		Value.	
	1890.	1891.	1890.	1891.
	Cwts.	Cwts.	£	£
Germany	4,609,610	4,100,919	2,763,454	2,549,674
Holland	345,352	328,488	199,382	202,577
Belgium	616,535	529,217	340,838	314,608
France	898,655	1,104,760	557,471	733,280
British West Indies & Guiana	1,060,398	818,439	802,893	645,303
British East Indies	460,999	746,826	237,045	391,868
China and Hong Kong	....	....	....	....
Mauritius	123,222	172,122	77,998	106,920
Spanish West India Islands	38,000	19,935	28,500	15,699
Brazil	281,316	366,432	170,797	232,437
Java	871,658	1,549,556	619,339	1,041,781
Philippine Islands	189,333	604,199	100,718	317,269
Peru	431,490	274,597	289,185	192,266
Other Countries	215,396	360,956	154,356	240,975
Total of Raw Sugars	10,141,964	10,996,446	6,341,976	6,984,657
Molasses	486,544	345,471	156,070	106,126
Total Sugar and Molasses	....	....	12,013,523	13,171,833
Refined Sugars.				
Germany	3,459,699	4,325,774	2,794,200	3,519,275
Holland	1,258,766	1,116,581	1,046,596	934,623
Belgium	98,354	111,086	88,305	98,213
France	1,786,483	1,293,458	1,451,285	1,068,120
United States	159,159	531,614	133,463	446,337
Other Countries	1,341	17,969	1,128	14,482
Total of Refined	6,763,802	7,396,482	5,515,477	6,081,050

EXPORTS.—Refined Sugars.

	Cwts.	Cwts.	£	£
Sweden and Norway	39,989	54,563	29,319	41,598
Denmark	96,816	94,372	59,358	59,638
Holland	61,180	59,008	43,339	41,886
Belgium	18,601	15,882	12,765	11,071
France	4,695	416	3,058	326
Portugal, Azores, & Madeira	57,511	44,851	38,319	31,385
Italy	59,810	30,137	40,477	21,626
Other Countries	154,001	189,800	116,916	141,071
Total of Exports	492,603	489,029	343,551	348,601

IMPORTS OF FOREIGN REFINED SUGAR.

The following figures give the imports of foreign refined sugar for the month of August, 1891, compared with the corresponding month of the two preceding years, and the average monthly imports for the year compared with those of 1888, 1889, and 1890, distinguishing the quantities of "Lumps and Loaves" from "other sorts," and giving the separate imports from each country:—

Countries from which Sugar has been imported.	"Lumps and Loaves." Including Cut Loaf and Cubes.							"Other Sorts." Including Crushed Loaf, Granulated, Crystallized, &c.							Total.						
	Monthly Average.				Aug.	Aug.	Aug.	Monthly Average.				Aug.	Aug.	Aug.	Monthly Average.				Aug.	Aug.	Aug.
	1888	1889	1890	1891	1889	1890	1891	1888	1889	1890	1891	1889	1890	1891	1888	1889	1890	1891	1889	1890	1891
	Tons.	Tons.	Tons.	Tons.	Tons	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France..............	1686	1888	3261	2098	1199	2418	2185	4855	3398	7904	6077	3619	7525	5998	6541	5286	11165	8085	4818	9943	8183
Holland	3267	3005	3211	3219	906	2843	3206	2675	3074	4656	3758	2502	5300	4672	5942	6079	7867	6977	3408	8143	7878
Germany & Austria*..	1510	2964	2762	3047	1118	2439	3188	11729	17245	18862	23990	6625	16780	24212	13239	20209	21624	27037	7743	19219	27400
Belgium	622	995	369	401	411	257	140	227	267	245	293	55	230	206	849	1262	614	694	466	487	346
United States	8	..	71	127	..	285	..	157	98	924	3195	32	4311	304	165	98	995	3322	32	4596	304
Russia..............	..	..	..	..	..	..	..	1959	4275	..	105	543	..	..	1959	4275	..	105	543	..	..
Other Countries	1	14	..	..	5	..	..	2	10	8	8	537	4	38	3	24	8	8	542	4	38
Total	7094	8866	9674	8802	3639	8242	8719	21604	28367	32599	37426	13913	34150	35430	28698	37233	42273	46228	17552	42392	44149

* Including some Russian.

SUGAR STATISTICS—GREAT BRITAIN.

FOR THE FOUR PRINCIPAL PORTS.

To Sept. 19th, 1891 and 1890.

In Thousands of Tons, to the nearest Thousand.

	STOCKS.		DELIVERIES.		IMPORTS.	
	1891.	1890.	1891.	1890.	1891.	1890.
London	40	.. 26	216	.. 203	230½	.. 180
Liverpool ..	44	.. 53	214½	.. 200	204	.. 166½
Clyde	9	.. 16	139	.. 159	122	.. 148
Bristol	1	.. 1½	48½	.. 49	47½	.. 47½
Total ..	94	96½	618	611	604	542

The above figures do not represent accurately, or to the full extent, the position and movements of sugar in the United Kingdom, as Hull, Leith, &c., are not included, there being no published returns for these ports.

SUGAR STATISTICS—UNITED STATES.

From Willett & Gray's Report.

For the four principal Ports. In Thousands of Tons, to the nearest Thousand. For August, 1891 and 1890.

	STOCKS. September 1st.		DELIVERIES. In August.		IMPORTS. In August.	
	1891.	1890.	1891.	1890.	1891.	1890.
New York	56	.. 28	59	.. 58	54½	.. 48½
Boston	4½	.. 4½	18	.. 13	14½	.. 12
Philadelphia....	3	.. 4½	48	.. 29½	43	.. 28
Baltimore	2	.. —	1½	.. —	½	.. —
Total......	65	37	126½	100½	112½	88½
Total for the year			1106	876	1143½	902

NEW YORK PRICES FOR SUGAR.

From Willett & Gray's Report, September 17th, 1891.

Fair Refining.	96o/o Centfs.	Granulated.	Stand. A.	Stock in Four Ports.
Sep. 17, 1891.—3c.*	3 7-16c.*	4½c.	4⅜c.	Jan. 1, 1891— 27,756 tons.
Sep. 18, 1890.—5 7-16c.	6 1-16c.	6⅝c.	6⅜c.	Jan. 1, 1890— 11,169 tons.
Sep. 19, 1889.—5¾c.	6½c.	8¼c.	8c.	Jan. 1, 1889— 32,254 tons.
Sep. 20, 1888.—5½c.	6½c.	7¾c.	7⅜c.	Jan. 1, 1888— 47,798 tons.
Sep. 22, 1887.—4¾c.	5⅜c.	6⅛c.	5¾c.	Jan. 1, 1887—102,279 tons.
Sep. 23, 1886.—4¾c.	5⅜c.	6c.	5⅝c.	Jan. 1, 1886— 57,328 tons.
Sep. 24, 1885.—5 7-16c.	6 3-16c.	7c.	6⅜c.	Jan. 1, 1885— 89,186 tons.
Sep. 18, 1884.—4⅞c.	5⅝c.	6 9-16c.	6 1-16c.	Jan. 1, 1884— 60,900 tons.
Sep. 20, 1883.—6 9-16c.	7 9-16c.	8¾ 13-16c.	8⅜c.	Jan. 1, 1883— 50,297 tons.
Sep. 21, 1882.—7 15-16c.	8¼c.	9¼c.	9c.	Jan. 1, 1882— 43,927 tons.

* Net Cash.

STOCKS OF SUGAR IN THE CHIEF MARKETS OF EUROPE ON THE 31ST AUGUST, 1891, FOR THREE YEARS, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining 4 principal entrepôts.	TOTAL 1891.	TOTAL 1890.	TOTAL 1889.
104	60	100	55	6	16	341	273	270

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING 31ST AUGUST, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining 4 principal entrepôts.	TOTAL 1890-91.	TOTAL 1889-90.	TOTAL 1888-89.
1378	534	506	291	57	385	3151	3096	2755

ESTIMATED CROP OF BEETROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE PRESENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1890-91. Tons.	1889-90. Tons.	1888-89. Tons.	1887-88. Tons.
German Empire..	1,332,000 ..	1,264,607 ..	990,604 ..	959,166
France	694,037 ..	753,078 ..	466,767 ..	392,824
Austria-Hungary.	778,473 ..	787,989 ..	523,242 ..	428,616
Russia	525,000 ..	456,711 ..	526,387 ..	441,342
Belgium........	200,000 ..	221,480 ..	145,804 ..	140,742
Holland	65,000 ..	55,813 ..	46,040 ..	39,280
Other Countries..	80,000 ..	80,000 ..	87,000 ..	79,980
	3,674,000	3,619,678	2,785,844	2,481,950

The differences in Mr. Licht's estimates, as compared with last month, are, Germany, 5,000 tons less; France, (official figures) 5,963 tons less; Austria, (official figures) 18,473 tons more; Russia, 5,000 tons less; the net difference being only 4,000 tons more than last month's figures.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

The figures for the month show that there has been a good steady business going through, though sellers have had to complain increasingly of want of animation in the market. The uncertainty referred to in our last month's report as to the European beet crop still continues, and the fine weather of the last few weeks has undoubtedly contributed to render buyers cautious. Prices of cane sorts close about the same as at the end of last month, refiners have had to submit to a small decline, and beet has gone down very slightly.

Messrs. Willett & Gray have published, and we have reprinted in this issue, what must, of course, be a very rough estimate of the supply of sugar which may be expected during the twelve months, October, 1891, to September, 1892, compared with the figures of the past years. The stocks at the end of August being estimated at about the same figure as last year at that time, we seem to have a prospect of no more sugar than will be required for the coming twelve months, and we are inclined to consider the estimated figures, in the table referred to, as being quite high enough. All such estimates are uncertain, but we shall not be surprised if an upward movement should take place during the coming twelve months.

Present quotations for the standard qualities, as under, are :—

Floating.			Last Month.
Porto Rico, fair to good Refining	12/9 to 14/-	against	12/9 to 14/-
Cuba Centrifugals, 97°/₀ polarization	14/9	,,	14/9
Cuba, fair to good Refining	13/- to 13/6	,,	13/- to 13/6
Java, No. 14 to 15 D.S.	15/-	,,	15/3
British West India, fair brown	12/3	,,	12/3
Bahia, low to middling brown	10/6 to 11/-	,,	10/6 to 11/-
,, Nos. 8 to 9	11/6 to 12/-	,,	11/6 to 12/-
Pernams, regular to superior Americanos..	10/9 to 12/6	,,	10/9 to 12/6
Landed.			
Madras Cane Jaggery..	9/9	,,	9/9
Manila Cebu and Ilo Ilo	9/- to 9/3	,,	9/- to 9/3
Paris Loaves, f.o.b...	17/- to 17/3	,,	17/4½
Russian Crystals, No. 3, c.i.f.	14/10½ to 15/-	,,	15/3
Titlers	18/9	,,	19/-
Tate's Cubes..	20/-	,,	20/3
Beet, German and Austrian, 88%, f.o.b. ..	13/3	,,	13/5

THE

SUGAR CANE.

No. 268. NOVEMBER 2, 1891. VOL. XXIII.

All communications to be addressed and all cheques, &c., made payable to "EDWARD SUTTON, EDITOR OF THE SUGAR CANE, MANCHESTER," which address is sufficient.

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☞ The Editor is not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

We have received reports of the working of the Evan Hall, Belle Alliance, and New Hope Plantations, belonging to Mc.All Bros. Manufacturing Co., and have great pleasure in reprinting the comparative summary of results given by Mr. Lezin A. Becnel, the Chemist in charge of the Evan Hall Plantation.

We are also indebted to Professor Harrison for a copy of his Report as Governmemt Analytical Chemist, and print that portion which relates to sugar matters. We regret that Professor Harrison is only slowly recovering from the combined effects of overwork and a tropical climate.

We have received from Mr. D. Morris, and reprint on page 566, a copy of a letter from the Viceroy and Council of India, respecting the *Alapore jowar*, which is interesting in connection with the present greater probability of sorghum sugar proving a commercial success in the United States.

Dr. Von Lippmann gave at the meeting of German sugar manufacturers held at Cologne, the following as the average result of twenty-seven trials made at the Halle Refinery, with the crystallisation in motion process.

The percentage of sugar obtained from the masse-cuite was 33·37, composition as follows: polarisation, 96·33; water, 1·60; ash, 0·88; organic substances, 1·18; test, 91·33; purity, 97·9. By the old

method the percentage of sugar was 38·72; polarising, 92·33; with water, 3·16; ash, 1·96; organic substances, 2·55; test, 82·53; purity, 95·4. The time required was from five to six days by the new process, against twenty to twenty-two days with the old style. There is therefore a large economy of time, but the other results amount to about the same in each case, as though the polarisation of the sugar from crystallisation in motion was higher, the quantity was less.

Negotiations for a treaty of commerce between Germany and Belgium are said to be concluded, excepting as regards sugar matters; the idea of both parties, however, is to reduce premiums and establish a more liberal régime. It will be remembered that Belguim was one of the opponents of the proposals made at the London Conference for the abolition of premiums.

The *Melbourne Argus* states that the new sugar refinery at Port Melbourne belonging to the Australasia Sugar Refining Company, Limited, is now fast approaching completion, and it is expected that operations will be commenced early in November. The total cost of the land, buildings and plant will be £150,000, of which £33,000 has been paid for the building. The site of the refinery is a convenient one, having Beach Street and Hobson's Bay to the south, and being close to the town pier. The full capacity of the refinery is 350 to 400 tons per week. A feature is that the plant has been arranged for the production of every conceivable kind of refined sugar, besides brewing sugars and syrups. The company has an influential share-holding list, largely representative of the wholesale grocery trade. The manager is Mr. J. J. Eastick, F.I.C., A.R.S.M.

The same paper informs us that Europeans are gradually taking the places in the mills and fields previously occupied by the Kanakas, and that little or no discussion ever takes place on the labour question now. This scarcely seems to agree with the following, taken from another Australian paper:—"Twenty-two Javanese, direct from the Batavia, arrived at Geraldton on the 26th August (says the *Advocate*) consigned to the Colonial Sugar Company's Goondi plantation. These labourers are the forerunners of 500 already on their way to the Johnstone. From this it would appear as if the Colonial Sugar Company intend providing against the withdrawal of the Kanakas by substituting Javanese. It was the Javanese, it will be remembered, who showed such a determined fight against the local authorities

about eighteen months ago, and this leads us to the reflection that an addition of 500 to their present ranks gives them a great and almost dangerous accession of power. If the aliens of this district were to rise in concerted rebellion, the white population would require all they knew, and a little added, to successfully cope with them, and whilst recognising this it is far from consoling to realize that one policeman is the full strength of local defence. The Javanese just arrived and to arrive are under a three years' engagement, their wages being 6s. 3d. per week and rations.

The Eton Central Mill (Mackay) has induced quite a number of settlers to grow cane, in addition to nearly 790 acres belonging to the Company, which calculates the cost of all cane to average this year 13/6 per ton. This mill expects to crush about 16,000 tons of cane, and to get 1,600, perhaps even 1,750 tons of sugar.

At the September meeting of the Louisiana Sugar Planters' Association, the subject of the distillation of molasses received special attention. Interesting and lengthy papers were read, and the discussion that ensued resulted in the view that at the present low price of molasses it would certainly pay to distil them. Some doubt was expressed by Professor Stubbs as to the advisability of making rum, as the demand for this article in the States is limited, and his idea was that it would be best to make alcohol. He considered molasses to be worth $2 to $3 as fertilisers. The members present were unanimously of the opinion that something must be done to find an opening for this product.

The following is from the *Sugar Bowl*:—Dr. J. A. Morrell, the inventor of the Cyclone Evaporator, and a concretor, suggests that molasses on the plantation be converted into concrete. He said to a reporter recently:—"I have already demonstrated the fact that cane juice can be evaporated to dry concrete without loss or injury to crystallising properties, thereby making it possible for the planter to send the entire saccharine output of his cane fields to the refinery, leaving no molasses behind to sour or ferment. Perfect filtration and defecation of the raw juice is requisite to insure a polarisation of the concrete sufficiently high to secure the government bounty, and after these are provided for, there is no reason why the planter should not send his molasses to the market in the form of sugar, and realise the great benefit of the difference in values."

The first application for a bounty under the sugar provisions of the new tariff was made October 1st, by the Chino Valley Beet Sugar Company, of California, and called for $2,000, two cents bounty on 100,000 pounds of sugar, testing over 90°, and manufactured between August 20th and August 29th. A second application was also received from the same company for $4,800 bounty on 240,000 pounds, manufactured between August 30th and September 5th. A notice of this new factory appeared in our September issue, pp. 464 to 466.

The German sugar manufacturers are being advised not to show their products at the Chicago Exhibition. On the other hand manufacturers of sugar machinery have every reason to exhibit, as they have a large prospective market before them, if the new projects respecting beet and sorghum cultivation are carried out.

The following information (in continuation of that given on page 341 of July issue) respecting the results of the 1890-91 campaign in the German sugar factories, is, as usual, mainly derived from the *Deutsche Zuckerindustrie.* The amount given in brackets indicates the share capital (in two or three instances including loan capital) of the respective company.

DIVIDENDS DECLARED.

Wendessen (M. 367,500), 25%; *Gross Zinkendorfer Zuckerfabriken*, 22%; *Dirschau* (M. 450,000), 16%; *Camburg* (M. 700,000), 15%; *Glauzig* (M. 4,500,000) farmed this year over 9,000 morgen of land, over one-third being devoted to beets, it also has a distillery and feeds cattle and sheep. The net profit from farm, sugar factory, and distillery was M. 562,200, out of which a dividend of 12½% has been paid; *Cönnern* (M. 180,000), 10%; *Markranstädt* (M. 450,000), 10%; *Kruschwitz* (M. 2,676,000), 8½%, after placing M. 100,000 to special reserve fund; *Körbisdorf* (M. 2,700,000) possesses, beside its sugar factory, over 1,600 acres of land, and last year worked, in addition, nearly 1,500 acres more; beets were grown on about one-third, the rest being farmed with corn, potatoes, fodder, and grass, it also has a coal mine. The net profit amounted to M. 219,334, out of which a dividend of 8% has been paid; *Neuwerk*, 8%.

NET PROFITS SHOWN.

Doebeln (M. 690,000), M. 289,373; *Hedwigsburg* (M. 465,375), M. 97,424; *Altenau* (M. 450,000), M. 153,088; *Eichthal* (M. 315,000), M. 115,953; *Mühlberg a. Elbe* (M. 810,000), M. 283,223; *Königslutter* (M. 592,500), M. 172,429; *Malchin* (M. 600,000), M. 148,307;

Hantheim (M. 300,000), M. 55,068; *Gandersheim* (M. 443,000), M. 68,483; *Greussen* (M. 472,500), M. 80,300; *Schwetz* (M. 790,000), M. 82,285; *Opalenitza* (M. 1,200,000), M. 109,905; *Zur Rast in Baddeckenstedt* (M. 379,800), M. 23,038; *Delitzsch* (M. 900,000), M. 59,934; *Brakel* (M. 1,242,000), M. 61,847; *Niederndodeleben* (M. 350,000), M. 16,487; this factory also produces chicory; *Sehnde* (M. 520,200), M. 26,108; *Obernjesa* (M. 1,110,400), M. 53,148; *Uelzen* (M. 450,000), M. 20,407; *Büdingen in Stockheim* M. 43,146; *Gross-Düngen* (M. 540,000), M. 16,844; *Nordstemmen* (M. 525,000), M. 9,119; *Neuhaldensleben* (M. 720,000), M. 13,638, which was carried to reserve fund; *Hasede-Förste* (M. 272,700), M. 3,175; *Rethen a. d. Leine* (M. 729,300), M. 1,563; *Garte* (M. 357,000), M. 1,581; *Goldbeck* (M. 720,000), M. 720; *Emmerthal* (M. 790,500), M. 864; *Altfelde* (M. 600,000), M. 324; *Seesen* (M. 371,250), M. 13; *Warburg* (1,063,500), *nil.*

The Magdeburg Refinery pays 6% on preference, and 2% on ordinary shares.

LOSSES DECLARED.

Oldesloe (M. 581,500), M. 70,502; *Frankenberg i. Schlesien*, M. 98,514; *Broitzem* (M. 230,250), M. 17,919; *Twülsptedt* (M. 400,000), M. 11,759; *Liessau* (M. 479,400), M. 8,795; *Dinklar* (M. 718,100), M. 4,425.

AUSTRIA.—The Schlappanitzer Zuckerfabrik pays a dividend of 10%.

The Society of Danish Sugar Manufacturers (*De Danske Sukkerfabrikker*) pays a dividend of 6%, after placing 250,000 kroner (£13,333) to special reserve fund. This Society consists of 7 beet sugar factories and refineries.

The diffusion process is being introduced by a Frankfurt Company on the Chocola plantation, in Guatemala, which has hitherto used the mill system. The Hanseatische Plantagen Gesellschaft Guatemala-Hamburg, which possesses estates in that country, is taking steps to extend the growth of sugar cane, which has been found to pay well.

The Sangerhäuser Actien Maschinenfabrik and Eisengiesserei pays this year a dividend of 33⅓ per cent. It is evident that these are good times for makers of sugar machinery.

There is talk in Russia of the formation of a company with several million roubles for the erection of refineries for refining by electricity. The Russians, as a nation, are, if we may believe Peter the Great, past masters in duplicity, so that it is probable the new scheme has a better foundation than that of the departed Freund, of unsavoury memory, otherwise it stands but little chance of Russian support.

SORGHUM SUGAR IN INDIA.

We have received the following from Mr. Morris, of the Royal Botanical Gardens, Kew:—

Royal Gardens, Kew,
October 20, 1891.

Dear Sir,

With reference to articles on "Sorghum Sugar" in India taken from the *Indian Agriculturist*, which appeared in the "*Sugar Cane*," Vol. xxii., 301-302, and *Ibid.* 343-344, I am desired by Mr. Thiselton-Dyer to forward the enclosed copy of a letter which has been communicated to this establishment on the subject by the Secretary of State for India in Council.

I am, sir,
Your obedient servant,
D. Morris,
Assistant Director.

The Editor of the "*Sugar Cane*,"
Manchester.

(Copy.)

No. 64 of 1891.

Government of India.

Revenue and Agricultural Department.

Agriculture.

To the Right Honourable Viscount Cross, G.C.B., Her Majesty's Secretary of State for India.

Simla, the 25th August, 1891.

My Lord,

With reference to your lordship's despatch No. 62 (Revenue), dated the 24th July, 1890, we have the honour to forward the papers noted at the foot,* and to inform you that we have endeavoured to obtain samples of the so-called Alapur sorghum sugar and Ajmir sugar-candy for the Museum of the Royal Gardens at Kew, but that our efforts have not yet been successful. Jai Narain Singh of

* Letter from the Government of the Punjab, No. 197, dated 26th December, 1890, and enclosure.

Memorandum from Foreign Department, No. 92-I., dated 8th January, 1891, and annexure.

Letter from the Government of the North-Western Provinces and Oudh, No. 154, dated 26th January, 1891, and enclosure.

Didwari, the native gentleman who was instrumental in bringing these commodities to the notice of the public, has offered to cultivate, during the ensuing season, the plant from which they are alleged to be made, and to manufacture therefrom a sufficient quantity of sugar which will be supplied to us by the end of the year. On receipt of the promised samples we shall lose no time in forwarding them to your lordship.

2. It will be observed from the enclosed correspondence that there is at present no evidence that sugar is manufactured anywhere in Rajputana or the Punjab from the Alapur or any other variety of sorghum. The Chief Commissioner of Ajmere states that it is not made within his jurisdiction, and that the name even of Alapur juar is unknown there. There is reason, moreover, to suppose that the sugar-candy famous in Rajputana is made from sugar brought from the North-Western Provinces and clarified in Bikanir. The Director of the Botanical Department of Northern India has been instructed to procure specimens of the Alapur juar from the districts in which it is said to be grown, and to identify them botanically. This report will be forwarded to your lordship in due course.

We have the honour to be, my lord,

Your lordship's most obedient, humble servants,

(Signed) LANSDOWNE.
F. S. ROBERTS.
P. P. HUTCHINS.
D. BARBOUR.
A. E. MILLER.
H. BRACKENBURY.
R. C. B. PEMBERTON.

GERMANY.

OPERATION OF THE NEW SUGAR DUTIES.

At the meeting of the Silesian Branch of the Union of German Beet Sugar Manufacturers, held at Breslau, in September last, the President remarked, in regard to the new sugar duties, that the Government was mistaken in supposing that competing States would be induced to lay down their arms in the battle of competition by the action taken by Germany; it was much more probable that the new German sugar duties would encourage them to carry on the conflict

with more prospect of success than hitherto, and to drive German sugar into the background. France had never been satisfied with merely introducing the well-approved duty on the raw material, but just as the success of the Prussian needle-gun had led other countries to go on improving their weapons, so France had understood how to manipulate the sugar legislation in an elastic manner and with a proper consideration of the State revenues, leaving the manufacturers free choice between the duty on the raw material and a direct premium, and so had afforded her sugar industry greater room for development, and would progress in the war of competition by means of these improved weapons.

The attention of the sugar industry should be specially called to a statement made in the *Berliner Politische Nachrichten*, a paper which was believed to be in touch with the Government. That statement was as follows:—"The new sugar legislation opens a prospect of an extension of the area under wheat cultivation, inasmuch as, after the entire cessation of the premiums, many districts, which at present were growing beets, would again grow wheat." This clearly pointed to a decline in the sugar industry, and this in spite of the fact, admitted in the article in question, that any reduction in the yield of corn, caused by beet cultivation, had only taken place here and there, because the diminution of the area under wheat had, as a rule, been more than balanced by the more intensive cultivation which was an indispensable accompaniment of beet growing.

In face of the impending crisis in the German beetsugar industry, they would have to demand from the Imperial Government the fulfilment of the promise given by Herr v. Maltzahn, to the effect that if the other States did not follow our example in abolishing the premiums, the time would then be considered to have arrived for strengthening the hands of the German sugar industry in the war of competition.

An examination of the results of the working of the German sugar factories during the campaign of 1890-91, which will be found in our July issue, and on a previous page of the present number, will show that, whatever may be the results to be expected under the new legislation (which comes into force August 1st, 1892) very considerable profits are being made in many instances, many of them such as may well raise a somewhat envious feeling in the minds of our refiners and planters, some of whom can with difficulty hold their own.

The Export of German Sugar to the United States.

A good many (occasionally contradictory) reports have been lately circulated respecting the existence of negotiations between Germany and the States which would admit of a mutual extension of trade. According to the *Deutsche Zuckerindustrie*, some of the most remarkable of these (coming, as a rule, from America) are evidently false, on the face of them, to any one acquainted with the facts connected with the regulations of the McKinley Bill and the reciprocity clause. The journal in question sums up as follows:—"On the point whether America consider the removal of the prohibition of importation of pork into Germany as not being a sufficient equivalent for the permission to allow raw sugar to continue to enter the States after the 1st January next, and has therefore demanded concessions for other of her products from the German Government, there is absolutely no reliable information. According to the tenor of the so-called reciprocity clause in the McKinley law, differential duties may be levied from the commencement of next year on sugar from countries which impose on agricultural or other products of the United States such duties or taxes as shall be considered by the President unequal and unfair in comparison with the exemption in the case of raw sugar allowed by the United States.

"It is not altogether impossible that the Government of the Union now that the permission for pork to enter has been accorded, may, with the desire to get something more, be thinking of deriving some further advantage from the clause referred to, and has therefore addressed further demands to Germany. The Imperial Government would, on account of the 'most favoured nation' treaties with other countries which also export corn, especially before the coming into force of the new treaties of commerce, find itself in a difficult position if the Americans should require a reduction or abolition of the German import duties on American wheat."

FRANCE.

Operation of the New Sugar Legislation.

The new law under which, it will be remembered, the refineries were subjected to the control of the excise, would seem to be producing unsatisfactory results if we are to judge by the following short article in the *Journal des Fabricants de Sucre* :—

"The absolute silence observed by the *Administration des Contribu-*

tions Indirectes respecting the results of the stock-taking (inventaire) which has been effected in the refineries, at the end of the first year's application of the fiscal control, is the subject of many comments in sugar circles. Both merchants and producers are asking what is the cause of this reserve, and they are beginning to think that the results of this mode of taxation—far from answering the expectations of the Minister of Finances and M. Charmes, who had calculated it to produce fr. 5,000,000—is absolutely negative.

"It is unbearable that that portion of the public interested in sugar, manufacturers, refiners, brokers, and exporters, should be left any longer in ignorance of the results of a fiscal measure which interests both industry and trade in the highest degree, both from the point of view of the financial consequences to the Treasury—for which the intention had been to secure a larger receipt—and of the effect on our export trade.

"The refiners are complaining of the adverse influence of the fiscal control on their exports of sugar, and, on the other hand, a report is current that the *Administration des Contributions Indirectes* has met with deficits in place of the overplus forshadowed by M. Charmes. If things are so, it would be infinitely wiser to acknowledge at once that a mistake has been made than to commit ourselves any further to a course which can only lead to deception or disappointment. In the name, then, of the interests of commerce and manufacture, we venture to insist that the fiscal authorities should publish the results of the inventories made in the refineries, and let us have light on the question as early as possible."

Premiums realised by French fabricants in 1889-90.

The fabricants were debited with an average yield of 7½ kilos. of sugar for every 100 kilos. of beets worked up; they obtained an average actual yield of 10·483 kilos., this is a gain of 2·983 kilos., or close on three kilos. This means that for every 100 kilos. of beets worked up, they have been benefitted on nearly three kilos. of sugar by the difference of the duty (40 frs.) between the full duty (60 frs.) levied on sugar representing the legal yield, and the reduced duty (20 frs.) leviable on the *excédents de fabrication*, namely these three kilos. (or nearly so) corresponding to about 1fr. 19c. This being so, as the total quantity of raw material was 6,665,802 tons, we may calculate the amount of the premiums granted during the 1889-90 campaign at frs. 79,000,000 (£3,160,000).

AUSTRIA-HUNGARY.

Results of the 1890-91 Campaign.

The number of factories at work was 213, being one less than in the previous season. The area under cultivation was nearly 10% greater than in 1889-90, and the quantity of beets (6,610,000) worked up about 6⅝% more. The production reached 767,419 tons, against 740,140 tons in the previous campaign, both amounts being in raw sugar value. The principal figures for consumption and export are:—

	1890-91. Tons.	1889-90. Tons.
Inland Consumption	254,591	258,494
Exported—Raw	240,250	166,462
Do. —Refined	234,082	246,157

The yield obtained in raw sugar was 11·61% of the weight of beets, against 11·94% in 1889-90. According to the *Prager Zuckermarkt*, the export of sugar from Hungary to the United States is beginning to assume some importance. The steamer "California" lately left Trieste for New York with 500 tons, shipped by the Hatvan factory.

UNITED STATES.

The Sugar Bounty objected to.

The article reprinted below appears in the New Orleans *Weekly Picayune*. One of the inevitable results of offering a bounty on one special article of manufacture or production, at all events in a country where such freedom of action is allowed as is the case in the United States, is an outcry for protection on the part of other branches of industry, and, in common justice, such a demand is well-founded in the majority of cases. That some modification of the existing bounty regulations may not be impossible, is evident from the large proportions which the sum to be paid is already assuming. The article is headed:—

"Growling at the Sugar Bounty."

"Governor Campbell, of Ohio, in the course of a campaign speech he made recently in his canvass for a re-election, is reported to have said, by way of indictment against the Republican party:—

'They take fifty-five millions of sugar tax out of the Treasury, tax you on something else to fill the vacancy, and put on twelve millions more of tax to pay a bounty to sugar growers down in Louisiana and up in Vermont, and then howl about having given you free sugar.'

"Governor Campbell is a Democrat. He knows perfectly well that the tariff on sugar offered a most convenient and little-burdensome means of

raising a revenue for the Government. He knows, quite as well, that the Democrats in Congress, while they proposed to reduce the duty on sugar, nevertheless recognized the necessity for raising a considerable portion of the revenue from that source. But the Republicans, because they thought they could thereby strike a heavy blow at the South, were determined to remove all duty on sugar, and they did so. But there arose a wild and portentous outcry. The people of Kansas, Nebraska, Iowa, California, and other Western States had recently embarked extensively in sugar making from the sorghum cane and the beet. The withdrawal of the sugar duties was a blow at a Western industry, and likely to work disaster to Western men and capital. The Republican Congress found that it had raised such a howl of indignation from Northern Republicans that something must be done for their relief, and as a result the bounty was voted.

"But a bounty to the Northern sugar farmers and the Southern sugar planters, while the corn, and wheat, and cotton, and hog farmers get nothing, must be necessarily a very unpopular measure. This is only the beginning of the bounty business. Not one cent of the bounty has been paid out yet. The aggregate of the sugar bounty will be some $10,000,000 or $12,000,000, and by the time that money shall have been paid out to the sugar raisers there will be loud expressions of dissatisfaction from the other agriculturists all over the country, and sooner or later Congress will repeal the bounty act. Attacks are already being made upon it, particularly by the Republican press. Here is one from the *Chicago Tribune* :—

'The sugar planters of Louisiana should receive no further aid from the General Government, because nothing which can be done by bounties can make their industry extend. Bounties are of doubtful constitutionality at best. They can be justified only by showing that the industry fostered by them will be able to take care of itself in a few years. The sugar planters of Louisiana have been nursed and coddled by the Government for over 80 years, and have proved to the satisfaction of every observer that for climatic and frosty reasons they cannot compete with tropical countries, and never can produce a tithe of the sugar the United States needs. There is but a limited area of land in this country where the climate allows sugar-cane to be cultivated at all; and in the sections where it does grow the product is usually small and uncertain when compared with that of Cuba. To give bounties to the Louisianians is to prop up a pauper industry, and keep them from using the land for the cultivation of more profitable crops.'

"It is useless to attempt an argument with a foe which relies on defamation and expressions of hostility to make its point. The simple fact is that there is in Louisiana alone, in the sugar-belt climate, a body of the best lands yet untouched by the plough, capable of producing ten times the sugar made in the State. This land has to a large extent been exposed to the risk of annual overflow from the river floods, but whenever our levees shall be able to give reliable protection to that region, there is no reason to doubt that it will be devoted to sugar culture. Besides Louisiana there is a very large body of land in Texas admirably adapted to sugar, while Florida is developing considerable sugar production.

"There is good reason to believe that the steady improvement in the processes for extracting sugar from the cane will result in making our sugar

industry independent of any Government help, but it would be a great injustice to turn loose at this juncture upon our sugar makers the bounty-protected beet sugar of Germany and France. But this would be in keeping with the policy of the Republican party to break down the Southern whites even at the cost of destroying the negroes of the South, whose very existence is bound up in the prosperity of the section in which they live. But fortunately the South is not alone concerned in the sugar industry. The recent reports which come from Kansas of important improvements in extracting sugar from sorghum will, if established, give an extraordinary impetus to the sugar business in the North West. The Northern Republicans cannot destroy the Southern sugar makers without dealing a heavy blow at their own people, and this they will not dare to do, even if they had the power. What a Democratic Congress may do is just now a subject for solicitude."

BRITISH GUIANA.

Report of the Government Analytical Chemist for 1890-91.

A perusal of the above report leads to the conclusion that a large amount of valuable work has been done during the fifteen months under review, and we gather from the details that Professor Harrison has had before him an unusually arduous task in re-organising and making the best of the materials which he found waiting for him on his appointment over two years ago. The mere fact of the state in which he found the laboratory and its appliances testifies to the comparatively primitive character of all former work and arrangements, and taking into account the considerable extension of the field of labour which late events have brought about, one scarcely wonders that the Professor has for a time succumbed to the effects of overwork, and been compelled to take a most needed rest. We have had the pleasure of receiving from Professor Harrison a sample of cane arrows grown from seedlings, and on inspecting it, no longer wonder at the difficulties connected with the initial study of the conditions of propagation by seed-grains, as the roproductive parts of the infloresence are exceedingly small. We reprint those portions of the report which relate to sugar and the sugar-cane. The analysis of a *soi-disant* "manure" and the accompanying remarks furnish a strong caution against the purchase of manures other than those which are supplied by long established and thoroughly reliable firms.

Sugars.—A considerable number (716) of samples of sugars have been polarised for merchants and others. At present we have four polariscopes of different construction in use in the laboratory, and a

good deal of trouble has been taken in verifying their graduations. The two instruments, the property of the Government, both give readings somewhat too low, the Soleil Scheibler instrument used by the late Mr. Francis reading ·3 of one per cent. and the new one or 40 c.m. shadow instrument by Schmidt and Haensch, showing ·12 of one per cent. below the truth. All the old measuring apparatus has been carefully tested and the corrections made by Mr. Francis verified. All the new apparatus imported during the year has been similarly tested and the necessary corrections in almost every case made.

MOLASSES.—Forty-one samples were examined but with results calling for no comment.

SUGAR-CANES.—Two hundred and fifty sets of samples of sugar-cane grown experimentally at the Botanic Gardens have been analysed. The results will be given in a joint report upon experimental agricultural work drawn up by the Government Botanist and myself. I must, however, here point out that the additional work thrown upon the laboratory by the extension of experimental work with the sugar-cane, with the objects of increasing its yield by seminal selection and of examining into its manurial requirements, is very great and has already taxed the resources of the laboratory to the utmost, and it has only been possible to make these analyses by the assistance given by my private pupil and assistant, Mr. J. Williams, and by working in the laboratory for hours considerably in excess of the usual official hours. From results already obtained, it is evident that the work in connection with this branch of enquiry will steadily increase and probably several times as many samples as are at the present examined will require to be analysed.

SOILS.—Twenty-three samples have been examined. Several of these were sent by planters; the remainder being from the Botanic Gardens, which have been examined very fully as a preliminary step in the proposed extension of experimental cane cultivation. The results of the latter will be given in the joint report alluded to in the previous section.

MANURES.—Forty-three samples of manures have been analysed. As a general result it appears to me that in many cases the quality (or state of concentration) of the artificial manures imported into this colony is distinctly lower than that of those used in Barbadoes. The following analysis of a sample of "manure" sent by the Government Botanist, the source of which, I believe, may be easily identified, is highly interesting. The manure in question was stated to be of use

as an insecticide, and in addition to be a valuable fertiliser. It will be noticed that the constituents upon which the value of a manure depends are conspicuous by their almost complete absence; and in fact the so-called manure consisted only of chalk soaked with a small proportion of gas water.

	Moisture	2·80
(a)	Organic matters	7·60
	Insoluble silica and sand	2·90
	Calcium carbonate	86·70
	Calcium phosphate	trace.
	Calcium sulphate	trace.
	Alkaline salts	trace.
		100·00
(a)	Contains nitrogen	·17
	Equal to ammonia	·20

CONSULAR REPORTS.

Japan.

The total import of sugar in 1890 was 102,765 tons, value £1,379,463, against 74,686 tons, value £973,365, in 1889. The brown varieties (from China and Formosa) increased from £321,000 to £483,000, and the white (from Hong Kong, China, Java, and Penang) from £638,000 to £879,000, all but £6,000 of the latter being from the Hong Kong refineries.

Canary Islands.

The cultivation of sugar-cane is increasing, but as the advantages derived from this industry are limited, and the production of early vegetables is so much more profitable—when the land is prepared—it is probable that sugar planting will be confined to districts where the distance and difficulty of transport to a seaport prevents the cultivation of perishable productions. At present in the island of Grand Canary there are four steam mills in working order, and two in construction; there are also 15 ordinary crushing mills, and the annual production of sugar is between 2,000 tons and 3,000 tons. In Teneriffe we have one steam mill and one ordinary crushing mill, and the production is about 300 tons.

Dutch Guiana.

The production of vacuum-pan sugar increased during the past year over the former year's production by 70,034 kilos., the total for

the year being 6,149,100 kilos. There was also a considerable increase in molasses, viz., 464,902 litres, making a total of 1,168,962 litres for the year. The increase in the muscovado sugar production in 1890 amounted to 535,119 kilos., the total production being 1,963,700 kilos. Rum shows an increase of 63,169 litres over the production of 1889, the total for 1890 being 532,239 litres.*

The plantations existing are for the most part dependent on British Indian immigrant labour, without which this colony would be a wreck, as other classes of immigrants who are free to choose their own field of work seek for the higher pay and the gambling prospective of learning something on the gold fields that may eventually lead to the possession of gold placers of their own, and independence, if not riches.

Aliens have equal rights with citizens in regard to the possession of property, but aliens have to take out a "Burgher Recht," or local citizenship, which does not affect their nationality, but enrols them in the residents of the colony, and gives them a right to vote if they possess sufficient estate for which they pay taxes.

There is a great want of labour in the colony, and the neighbouring British colonies supply a large proportion of the reliable workmen. British Indian immigrants serve on the plantations, but there is plenty of room for everyone who wants to work with his hands in the field and on the placers if he is only acclimatised.

Netherlands.

The sugar industry is of considerable importance. The number of establishments for receiving it having for some years been about 30. In 1889 the number of refineries was 13, the total amount of sugar imported being 90,000 tons. The total export of refined sugar was 82,000 tons, of 67,740 was exported to England, 3,605 to Sweden, and 5,520 to Germans. The total amount of exports of native grown raw beetroot sugar was 9,641 tons, the amount exported to England being 3,758 tons, and to Belgium 4,426.

As next to no colonial (cane) sugar now comes to Holland, the refineries and consumers are now supplied nearly altogether with foreign and home-produced beet sugar. Prussia and Austria, formerly the chief sources of supply, now send much less than before, while the import of Belgian beet sugar has correspondingly increased.

Efforts are still being made to induce the Government to abolish the excise duty gradually, but the needs of the Treasury have been such that up to the present there seems but small chance of such a project being adopted.

CENTRAL FACTORIES.

For some time past there have been indications in several of the West India Islands, for example Jamaica, Antigua, and Trinidad, that the main hope of saving the sugar industry lay in the erection of central factories, which is either being actually carried out, or about to be, in the islands named. In this connection the following, from the *Glasgow Herald* will be of interest:—

"Owing to the close competition between the cane sugar and beetroot sugar manufacturers, every known means has to be applied to reduce the cost of manufacture. One means now being adopted by cane growers is the amalgamation of a number of estates into one larger factory or *usine*, and, in place of a number of small estates making their own sugar, all the canes are brought to one central set of sugar-making works, and thus the expense of management and manufacture is reduced, and fuel saved. This necessitates that a larger quantity of juice has to be treated per hour than heretofore, so that the evaporation of the water out of this juice comes to be a very serious matter. Messrs. M'Onie, Harvey, & Co., the well-known sugar engineers of this city, have just finished one of their largest "Patent Trifle Effets" for this purpose. This apparatus consists of three upright vessels, each 11ft. diameter inside; the lower portion or calandria of each vessel is fitted with 1666 brass tubes, 2in. diameter by 5½ft. long, giving a total heating surface of 13,500 square feet: the upper portion is built of steel plates, having extra large pipes on top, leading the vapour over and down to the calandria of next vessel. This apparatus is fitted with their patent arrangement for the distribution of the vapour and circulation of the juice, which has given a very high ratio of evaporation per square foot of heating surface, and, being very simple in its arrangement, one man can work the apparatus. The whole is fitted upon a massive iron staging, the last vessel and condenser being connected to a displacement vacuum-pumping engine of ample capacity. This apparatus is made to the order of the Colonial Company, Limited, London, for their Usine "St. Madeline" at San Fernando, Trinidad, and is capable of doing the work required for the manufacture of from five to six tons of sugar per hour, and should be a valuable addition to their plant to meet their increasing output of sugar."

THE STEFFEN PROCESS.

Most of our readers will probably be aware that, in the course of the year 1888, Mr. Carl Steffen, of Vienna, took out patents for refining sugars by a methodical process of washing raw sugar or masse-cuite by saccharated solutions of different densities, the success of which was sufficient to secure their adoption in several refineries and to induce the formation of the great Steffen Syndicate which founded the Ungarische Zuckerindustrie Gesellschaft, and the huge refinery now being erected at Aussig (Bohemia).

A description of the process will be found in *The Sugar Cane* for September, 1889, pp. 457 to 460.

Mr. Steffen has now brought forward what may be considered as an extension of the original idea on which his process is based, by which he proposes to obtain from any syrup under treatment the whole of the crystallisable sugar in an absolutely pure state by a very simple process. This is certainly a revolution in the methods hitherto practised, but the practicability of the process can only be tested in actual working. Dr. Kronberg, who undertakes the reports on patents for the *Deutsche Zuckerindustrie*, says the new patent will certainly cause some shaking of heads among practical refiners, as it upsets all traditional usage. We give the following translation of the concluding remarks of Dr. Kronberg's description of the process:—

"We shall await with much expectation a proof in actual figures, derived from the results of next campaign, of Mr. Steffen's assertion respecting the high yield attainable. By the admixture with molasses the green syrup adhering to the crystal grains in the masse-cuite undoubted suffers a reduction of its quotient of purity, *à priori*, then, the capability of further crystallisation is diminished, and it appears to me very problematical whether any variations in the viscosity of the green syrup and its admixtures with molasses can not only make good, but also counterbalance this disadvantage, as we are further required to suppose. It really seems, in this case, as if the successful results of crystallisation in motion had led the inventor on a wrong track; anyway, I and all sugar manufacturers will rejoice if he should succeed in proving the contrary by unimpeachable figures obtained in practical working."

CUBA.

It would appear from the tenor of an article in the *Revista de Agricultura*, that the results of last season, in spite of the advantages of new machinery and an abundant crop, have not been sufficiently encouraging to enable that organ of the Cuban planters to take a very hopeful view of the situation.

The *Revista* declares that the numerous arguments which it has from time to time adduced, proving to demonstration that the American treaty is in no way favourable to the Cuban industry, have produced little effect; but they are not going to be deterred from continuing their efforts. The following translation of the concluding remarks of this article, entitled "La Situacion," may help our readers to some extent to form a judgment as to the actual state of affairs. We had supposed, from the success attending the negotiations apropos of the new treaty between Spain and America, and the statements respecting the results obtained by the new diffusion process on certain estates, that things were in a much more satisfactory way than seems to be indicated by the declarations of the *Revista*, which surely must be better informed than any other authority, as it is the official organ of the Union of Cuban planters and agriculturalists. The somewhat pessimistic view of the situation may to some extent find an explanation in the probability of the Government levying new taxes on the planters to reimburse the loss of revenue caused by the decreased Custom-house receipts, which are the immediate result of the new treaty arrangements with America.

"In face of the general crisis amongst producers, the competition (steadily becoming more fierce and tenacious) which our principal source of wealth has to sustain with other countries, in which the manufacture of sugar receives efficient assistance, in face of the powerful stimulus of the premiums granted in favour of the industry in the neighbouring republic, which is, in turn as it were, our only market, we must redouble our efforts, we must apply a hundredfold more energy if we want to secure and derive some solid benefit from the large sums which, during the last few years, have been expended, and the continual sacrifices made for the improvement of the factories by our planters, unaided and on their own initiative."

"Planters must then do their utmost, in the campaign now undertaken, to strengthen and consolidate their industry, which is in imminent danger in face of the skill and activity of its competitors,

and at the same time they must not be afraid of applying the necessary means of increasing the yields obtained with the materials which they possess at present, and when we speak of yields we mean *practical yield*, that is such yield as is convertible into actual disposable cash, and not those ficititious yields which are expressed in so and so much sugar per cent. of the cane, the fact being that sometimes, *with most notable results*, the cash box of the estate has remained empty, because in obtaining them more has been expended than was produced by the crop, for the season has scarcely been concluded when the proprietor has had to have recourse to heavy loans at exorbitant interest. And how can this increase of yield be obtained? By carefully avoiding all expenditure which will not be remunerative in a short space of time. By making, at the outset, an accurate study of the appliances at the disposal of the estate, and if their resources are insufficient, keeping things as they are rather than introducing incomplete reforms; if the resources are sufficient, employing them in strict subjection to the plan resulting from the preliminary study, thus avoiding hasty and ill-considered reforms, which absorb the greater portion of the available capital, without producing a corresponding increase in net benefit. In a word, by not returning to the stale custom, when the month of September arrives, of beginning to peddle about with bricks and tools in the boiling houses, without either general or detailed plan, the proprietor putting himself into the hands of the machinists or managers, in their turn influenced, though animated by the best intentions, by advice on theories, sometimes interested, the *result being, as has frequently been the case*, that, on commencing the campaign, they discover that the alteration which has been made at so great cost is not of the importance that has been supposed, while the actual and true cause of the waste or the bad working goes undiscovered, so that they have to enter on another fresh campaign with a deficit in prospect instead of the benefit which had been expected."

THE SUGAR INDUSTRY IN EGYPT.

By Mr. Killingworth Hedges, M.Inst.C.E.

It will be quite another year before the new railway bridge, which is in course of construction over the Nile, at Boulak, will be finished, enabling passengers for the south to start from the Cairo Station,

instead of having a long drive to the present terminus of the Upper Egypt Railway, which is at Boulak Dakrour. A seven hours' journey through a most fertile country, teeming with stock, and green with the first crop of "burseem," or clover, brings one to the headquarters of the vast agricultural country which is known as the lands of the Daïra Sanieh. At first the reckless expenditure of capital by the ex-Khedive Ismail prevented any return being obtained either as interest or profit, but since the administration of the estates has been placed in the hands of a mixed commission of English and French, instead of being a burden, the cultivation of the land, and consequent employment of labour in the factories where the raw products are prepared for the European markets, has enabled not only the interest on the Daïra loan to be punctually paid, but has also rendered a reserve fund probable, which will no doubt be used for extending the factories.

The growth of the sugar cane and cotton plant are the principal industries on the lands of the Daïra Sanieh. These have an area of 327,000 acres, and are all under an irrigation system which of late years has been greatly developed, a special department having been formed on the Indian model, with English engineers for each district, who have been selected by Sir Colin Moncrieffe, the engineer-in-chief. Main canals run through the provinces, and from these branches are taken until the whole of the supply has been usefully distributed on the land. There is still a need for more reservoirs to pen up the water of the Nile when in flood, and a surveying party is now in Upper Egypt examining the proposed sites. Whether the Lake Moeris scheme of Mr. Cope Whitehouse, which has been so often advocated by this gentleman, will be included as suitable for one of the proposed reservoirs in Lower Egypt is uncertain. Although the flooding of the ancient lake would bring prosperity to the adjoining country, it would do nothing to help the irrigation of the country above; hence the delay in accepting Mr. Whitehouse's plan. On our way up country we had plenty of evidence showing that the late Egyptian Government did not neglect to try numerous methods of mechanical irrigation. There are screw pumps and centrifugal pumps, by almost every known maker, lying idle by the score, and in most cases destined to remain so, while the pole and bucket of the "shadóof," worked by the Egyptian peasant or "fellah"—these contrivances raising water perhaps 30ft., by a series of lifts—are seen at work in every direction, until the borders of Nubia are approached, when the shadóof gives

place to a clumsy water-wheel pump, called a "sakieh." A certain portion of land is irrigated by each pump, which is turned by oxen. The late Government found these wheel-pumps a convenient means of taxation.

The Daïra lands are for the most part prepared for cultivation by the administration, who own over forty sets of steam ploughing tackle. The planting of the cane is done by the tenants, who are fellaheen, and who pay a rent of from £9 to £15 per acre. The whole of the crop is purchased by the Daïra by weight at a fixed price, so that all the tenant has to do is to cut the canes and bring them to the trucks. The price varies according to the quality and abundance of crop; for this year, which is a very fair one, the pay is 7½d. per 100lb. of canes cut and delivered. The canes are planted in February and cut in January of the following year. For the next succeeding two years other light crops are sown—for instance, "burseem," or clover, may be grown the first, and the land allowed to lie fallow the second year, the canes being again planted the third year.

The sugar factories are thirteen in number, and may be classed as ten complete factories and three half-factories. They are named after the "teftisches," or estates, which surround them, and stretch from Bibeh in the Lower to Motannah in Upper Egypt. The oldest have been established sixteen years, and nearly all those in Upper Egypt are connected by an agricultural railway about 500 kilometres in length, of standard gauge, which not only enables the canes to be brought to factories, but also completes the connections with the railway which extends as far south as Assiout, but which is under construction to Girgeh, and will before long reach Assouan, where a short length of line already constructed enables the first cataract to be passed.

The canes are first cut and trimmed, then stacked on camels. The large bundles are secured to the camels by a single rope knotted round a stick, the removal of which allows the load to drop alongside the railway trucks. A train of, say, six trucks is shunted on to a raised platform at the factory, parallel with which is an endless revolving ladder, which raises the canes to the mill, the speed of delivery being regulated by a feed roller, which can be quickly raised or lowered by means of a large hand-wheel.

As regards the details of sugar manufacture, the machinery is all of French manufacture, and principally comes from Messrs. Cail, Paris, who have now supplied nealy all the mills belonging to the

Daïra Sanieh. With the exception of the addition of lime to the juice in the defecators, no chemical is employed. The only process in which power is not utilised is that of the scum presses; the latter are of simple screw design, and must be extremely tiresome to work; however, labour is cheap, and the power presses tried have not been successful. The process ends with the centrifugals. A fairly white sugar is produced, which is lifted by a canvas belt, with side pieces of rubber, to a floor above. The crystals are weighed and bagged ready to be exported to Europe, where, curiously enough, the demand is great, while in Egypt the lower price of the imported beet sugar keeps home production out of the market.

Power is supplied by beam engines erected in suitable positions; these are worked at a considerable back-pressure, the exhaust steam being utilised for heating purposes. The boilers are after the locomotive type, only with extra large fire-grates. The "megass," or crushed cane, having been taken by the agricultural railway to the drying fields, is delivered by trucks in heaps close to the furnaces. It is fed by hand through a hinged furnace door, which leaves a space over a flat plate. The ashes, when thoroughly burnt, are pushed forward by a rake, and drop through the bars into a tunnel below, which runs under all the boilers. In all the factories a high brick chimney is erected for coal burning, but when megass is used a much less draught suffices, and an ordinary short sheet-iron chimney fixed above each boiler gives the best result. The facility with which this waste product megass is utilised has been the result of long practice, the evaporative efficiency of $2\frac{3}{4}$lb. of megass being equal to 1lb. of ordinary coal used under the same conditions.

The factories work night and day during the winter months, in shifts of six hours each, a European manager or deputy having to be on duty all the time. With this exception natives attend to everything, and work carefully and willingly, although the wages are on a scale which would be considered ridiculously low in Europe.

The larger factories manufacture their own gas for lighting purposes, but the results are not satisfactory. The electric lighting question is now receiving attention, and the writer has lately visited the factories, at the request of the authorities, for the purpose of reporting as to the cost of establishing and maintaining an installation of electric light, which shall not only illuminate the interiors of the buildings, but also the receiving yards and megass drying fields, the latter being the most important, as over 300 men are nightly employed outside each factory in drying and preparing the megass, and in transporting the canes to the mill.—*Industries.*

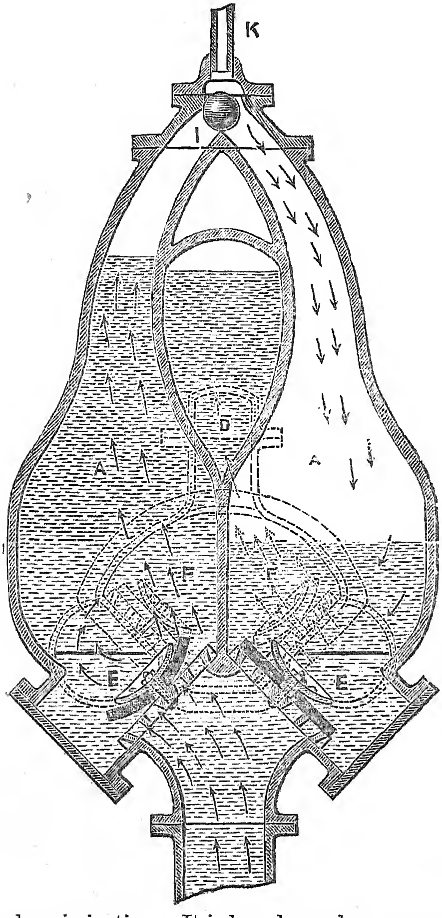
THE PULSOMETER PATENT STEAM PUMP, WITH THE "GREL" ARRANGEMENT.

This form of steam pump, which has been before the public for some years, appears to have become generally appreciated for the special advantages it offers over other steam pumps as regards facility of application, efficiency, and comparative cheapness both of prime cost and working. Some of the special features claimed for it are the following:—Its not being subject to wear,—the only parts which wear, and that only slowly, being the valves, readily renewable at small cost; skilled labour not being requisite; smallness of space occupied, and cost of fixing insignificant; the ability, where work is of a uniform character, to go on for weeks without any attention, working equally well suspended by chain or rope, or while being lowered as when fixed, being thus especially adapted for sinking work; capability of being used in confined spaces without causing over heating, as there is no exhaust steam. It is also said to be able to deal with gritty and semi-liquid substances without detriment, there being no frictional parts, for which reason it will start at once after lying unused for long periods. Neither oil, tallow, packing nor leathers are required, there being no rods, pistons, nor glands.

The "Grel" arrangement, which is a later invention than the Pulsometer itself, is an arrangement for automatically cutting off the steam at every stroke, effecting a saving of 40 to 50 per cent. in the total steam consumption, with very slight wear, and little liability to get out of order. This is especially of advantage in the larger sizes.

The construction of the Pulsometer is tolerably well known, but may be seen from the accompanying illustration. The working is characterised by great regularity, and accompanied by little agitation of the water, the condensation of the steam being therefore minimised; the steam ball of the valve and its seats, being made by special machinery and appliances, are perfectly true, and the ball wears both itself and its seats true; it is further claimed that this spherical steam valve, when properly constructed, is the best of all forms for distributing purposes. A very special advantage seems to us to be the faculty, due to the absence of frictional parts, of being started at a moment's notice, even after comparatively long disuse. We can conceive situations in which the difficulty of starting, which is not unfrequent with ordinary pumps after being idle for only a short time, might be a matter of very serious moment.

The applications of the Pulsometer are exceedingly varied. It may be employed for emptying docks, excavations, wells, or swimming baths, for draining underground workings, as all kinds of dirty matters, sludge, &c., are also taken up by it, coal washing, raising



water for stock or irrigation. It is largely used on sugar plantations, and in sugar factories, for pumping cane juice, whether hot or cold, and transferring it from one part to the other, in which it has proved a complete success; also for irrigation and general use about the works, such as in well sinking and pumping to supply the factory, and for draining foundations. The Pulsometer is manufactured in sizes adapted to pump from 900 to 80,000 imperial gallons per hour.

JAMAICA.

SUGAR-BOILING, "OPEN BATTERY."

(From the *Jamaica Gleaner*.)

As there appears to be a growing local demand for Agricultural Notes and Queries, perhaps such information as may be gleaned from a retrospective glance at the dawn of progress in the manufacture of cane-sugar, may be interesting to many of our clients, urban as well as rural; and, so, to-day, on the subject at the head of this article, we will take up our parable; but it will not be a prophetic utterance, but merely—as we have already said—a retrospect and a review. Nevertheless it may be well for us to look back to the beginnings of improvement in the art and science of the manufacture of cane-sugar in the British West Indies; and especially, for us—in Jamaica. It will make us alike cautious and hopeful—enterprising, yet careful in regard to still further improvements and wider developments, which may yet serve to restore a present languishing local industry, to its former condition, as a source of great national activity, commerce and wealth.

We have recently referred on two or three occasions to the Caymanas Estate, within easy access from Kingston, as at present a model Jamaica sugar plantation, and to all intents and purposes a central cane-sugar factory; and it is to the Caymanas principally, we shall now return in making our retrospect. We have not ourselves been able to visit this property for some years past, although we have recently presented to our readers an authentic and graphic account of its present flourishing scientific and renumerative condition, under the proprietorship of Messrs. Crum-Ewing and Co., of Glasgow, and the able supervision of the present manager, W. Kemp, Esq., but between 20 and 15 years ago, we were often on Taylor's Caymanas, then under the charge of the late William Berry, Esq., who, when he retired to manage his own pen property, was succeeded by Joseph Reid, Esq., who had been for many years previously at Lluidas Vale or Worthy Park Estate in St. John's. Caymanas has a history, as one of the oldest sugar estates in Jamaica, but, in this connection, we will not go further back than our own opportunities of observation; and for our remaining space to-day we will narrow the matter down, as much

as we can, to cane sugar manufacture; even apart from its agricultral treatment in the field. Although indeed old-time experienced Jamaica sugar planters had a saying, "Sugar is made in the field;" they knew that the work in the boiling-house was to get as much of it (*i.e.*, sugar) as possible, out of the cane, with as little detriment in quality, and loss in quantity, as could, by the appliances, then used, be accomplished; and this might be fairly well done, even with an old-time "open battery," when the soil was good, the seasons favourable, and the expenditure on "cultivation" generous but judicious, for instance at Worthy Park, above referred to, which at the period now being dealt with we also knew very well as a sugar estate. This fine property has all the advantages we have just named, tempered only by one draw-back, viz., distance from the "barquedier," and a very long and steep up and down hill of some 10 miles even to the present railway depôt at Ewarton. Worthy Park (we speak as we knew it some 15 years ago, or more), made, with open battery, good grocers' muscovado sugar, which was about the same in quality from the first to the last skip of a crop of from 700 to 800 tierces; and it was generally sold by the whole crop to a wholesale house *by one sample*, the London brokers being Messrs. Mayo and Mann. But the case of the Caymanas was different. Mr. Reid was a crack planter; but it took him all he knew to try to manufacture decent "grocers'" sugar at Caymanas; despite all the other advantages he had there, viz., rich land, sufficient coolie labour, and facility for shipping his crops and obtaining all his supplies,—light or heavy—imported or local, and lastly the owner, Crum-Ewing, Esq., was an enterprising progressive, skilful and experienced capitalist. You may ask "what more could the manager of a Jamaica Sugar Estate require?" Well, as sets off to these very great advantages, the soil was very heavy, in rainy weather nearly a swamp, and on the other hand, for at least seven months in the year, the district was subject to and sometimes sorely afflicted with drought. The drought season, too, was the natural period of cane-growth, and the rains came when the sugar *ought* to have been maturing in the plant. So the result was that Caymanas sugar was just "tar;" the grocery trade would not look at it, but the refiners knew what it was worth; for, despite its dark colour, it had plenty of sugar in it. The English sugar duties were still high, and for all grades alike. Caymanas sugar must be improved, or it seemed that, like the majority of old-time sugar estates in Jamaica, it

must be "thrown up" and go out of cultivation. To compete with the rains on the heavy ploughed land, deep soil draining was commenced, and irrigation was the only method to overcome the all but annual droughts. A turbine wheel driven by a windmill was erected at a great expense, to pump up the Caymanas lagoon waters, some 10 feet or so, which was sufficient to irrigate even the upper cane fields at Taylor's Caymanas; and this device was pretty successful, the wind being strongest when the weather was driest. Since the Government Rio Cobre Irrigation waters have been brought down to Caymanas, a copious supply for irrigation and all other purposes has been obtained from this latter source. The works required to be re-organised—indeed re-built, and stable foundations were hard to secure, where you came to water, even in the driest weather, by sinking to six or eight feet; and all renovations and reconstructions of plant had to be commenced and ended between crop and crop; or the financial loss would have been frightful. The old beam engine, a fairly good one, but one of the first ever used on a sugar Estate in Jamaica, was not able to drive the more powerful mill, and the extensive clarifying apparatus that had to be erected; and the additional need of steam for these last, and for the centrifugals, necessitated two or three multitubular boilers; the whole boiling battery also had to be re-arranged and duplicated, to run off the crop rapidly while the canes were at their best, and then—when all this, with careful forethought and large but judicious expenditure of capital, had been duly done—Caymanas open-pan sugar was certainly much improved, but still was not up to the grocery grade produced at and shipped from Worthy Park at two-thirds the cost. But then even a worse thing came upon even the advanced cane-sugar manufacturer,—beet root sugar manufacture by open battery soon proved itself a total failure. It was in vain that the agricultural chemist taught the French and German farmer, by the use of proper manures and skilful field cultivation to bring up the saccharine quality of the white Silesian beet, from seven to 30 per cent.; for in the boiling-house one-third of this sugar was totally destroyed in the open pans, and most of the other two-thirds was converted into uncrystallisable "grape" sugar, the beet refuse being, however, still a good winter fodder for cattle. So chemistry and mechanical science had to be applied, no less to the manufacture than to the culture of beet root sugar, and it is in both these directions then that the European root sugar grower has

distanced his tropical cane-plant antagonist; and probably would have done it on these lines, even if he had not had Continental bounties and British Free Trade tariffs to help him. All this shows how much lee-way the West Indian sugar planter has to make up. But as we have already said, the cane will still repay, under all present disadvantages, an expenditure of capital and enterprise upon it, equivalent to those that have been bestowed upon the beet. It seems to us to be a logical a-fortiori, or a proportional progression to affirm—scientific cane manipulation being equal to the like treatment of beet—that bounties in behalf of the latter will be more than out weighed in favour of facility of tropical cane-growth, comparative cheapness of labour, and above all the much superior quality and quantity of "Saccharose" that the cane can be got to yield. Sir Lyon Playfair (*Nineteenth Century Review*, September, 1888), says: "The mere accident of local advantages is now a small factor in the industrial competition of nations, for trained intelligence, required to convert them into utilities, has become the great and growing factor of production."

(To be continued.)

STUDY OF A METHOD FOR THE QUANTITATIVE DETERMINATION OF SUCROSE, INVERT-SUGAR, AND DEXTROSE, OR LEVULOSE.

By F. G. Wiechmann, Ph.D.

(Continued from page 472.)

Series No. 6 and No. 7 show the effect of a constant amount of acid, with constant time of boiling, on different mixtures of invert-sugar and dextrose, and of invert-sugar and levulose.

The values obtained in Series No. 6, with one exception (ratio 95 : 5), all show that *less* copper was reduced than should have been reduced.

The values in Series No. 7 all show, without exception, that *more* copper was reduced than should have been reduced.

The significance of these data is evident.

In the case of invert-sugar (Series No. 1), where the proportion of dextrose to levulose is as 1 : 1, four hours' boiling with 60 c.c. HCl

(6x normal strength) resulted in a destruction of the levulose almost theoretically perfect.

Series No. 6 demonstrates that, if the substance operated upon, under the same conditions named above, does not consist of dextrose and levulose in the proportion 1 : 1, but contains an *excess* of dextrose, *dextrose as well as levulose* is destroyed.

Series No. 7 demonstrates that, if the substance operated upon under the same conditions, does not consist of dextrose and levulose in the proportion 1 : 1, but contains an *excess* of levulose, *the levulose is not all destroyed.*

It is therefore proved, that this method of analysis cannot serve for

Series VI.—Invert-Sugar and Dextrose.

0·25 gramme dry substance used in each experiment.

In each instance:

Time of Boiling, 4 hours. Amount of HCl (6x normal strength) = 60 C.C.

Ratio of Invert-Sugar to Dextrose.	If all levulose, and *only* levulose were destroyed, there would be reduced of Cu:	There *were* reduced of Cu:	
50 : 50	0·3460	0·3215 0·3218	0·3217
60 : 40	0·3238	0·3106 0·3112	0·3109
90 : 10	0·2572	0·2560 0·2573	0·2567
94 : 6	0·2526	0·2397 0·2428	0·2413
95 : 5	0·2462	0·2484 0·2498	0·2491
98 : 2	0·2392	0·2365 0·2380 0·2405	0·2383

the determination of the relative amounts of invert-sugar, dextrose, or levulose, when these occur together. The solution of this problem, if it is to be attempted on these lines, calls for the discovery of some

reagent which will, under *all circumstances*, destroy absolutely the one of these sugars, dextrose or levulose, and not affect the other.

Such a reagent would prove of the greatest value for the study of important problems in connection with the sugar industry, and by its aid we might also hope for the disclosure of some of the most closely-guarded secrets of nature's laboratory—the formation of saccharine juices in the vegetable kingdom.

Series VII.—Invert-Sugar and Levulose.

0·25 gramme dry substance used in each experiment.

In each instance:

Time of Boiling, 4 hours. Amount of HCl (6x normal strength) = 60 C.C.

Ratio of Invert-Sugar to Levulose.	If all levulose, and *only* levulose were destroyed, there would be reduced of Cu:	There *were* reduced of Cu:	
50 : 50	0·1177	0·1693 0·1718	0·1706
60 : 40	0·1413	0·1765 0·1770	0·1768
90 : 10	0·2119	0·2236 0·2247	0·2242
94 : 6	0·2238	0·2280 0·2252	0·2266
95 : 5	0·2233	0·2254 0·2263 0·2303 0·2307	0·2282
98 : 2	0·2308	0·2410 0·2410 0·2430 0·2440	0·2423

RESULTS OBTAINED ON EVAN HALL, BELLE ALLIANCE AND NEW HOPE PLANTATIONS.

CROP OF 1890.

FIELD RESULTS.

According to the special reports for the various plantations, the tonnage per acre is as follows:—

	Plant.		Stubble.
On Evan Hall	32·24	..	22·36
On Belle Alliance	31·00	..	20·00
On New Hope	33·52	..	20·72

NOTE:—Plant and stubble not kept separate on Ascension.

By comparing the above data, the best plant cane results are found on New Hope, Evan Hall's being 3·28 per cent. and Belle Alliance's 7·52 per cent. inferior to New Hope's. Compared with Evan Hall, Belle Alliance's plant cane shows a shortage of 3·85 per cent.

On stubble, New Hope is found to be 7·33 per cent. behind Evan Hall; and Belle Alliance 10·55 per cent. inferior to Evan Hall, and 3·60 per cent. under New Hope.

Since the acreage of plant and stubble ground on each plantation varies, it is thought fairer to compare the general results from the standpoint of equal areas of plant and stubble. Accordingly the general average results were:—

	Tons.
On Evan Hall	27·30
On Belle Alliance	25·50
On New Hope	27·12

This shows New Hope's general result to have been only 0·66 per cent. below that of Evan Hall; and Belle Alliance 5·97 per cent. below New Hope's, and 6·59 per cent. under Evan Hall.

The difference between New Hope and Evan Hope is so slight that it can very well be neglected, and in all probability, that between Belle Alliance and the other places is due to the greater proportion of skiff land on Belle Alliance.

MANUFACTURING RESULTS.

RUNNING TIME.

On the basis of the total number of calendar days required to take off the various crops, and the actual number of days during which the mills run, the following percentages of lost time are noted:—

	Per cent.
On Evan Hall	12·30
On Belle Alliance	11·70
On New Hope	25·40

The large percentage of lost time at New Hope is, to great extent, the direct result of not running the sugar house on Sundays. If allowance be made for Sundays, the percentage of lost time is reduced down to 10·50 per cent., or about the same as on the other places. However, owing to certain necessary repairs to machinery, such as renewing leaky joints, cleaning the evaporating pans, &c., a 24 hour stop every two weeks is thought to be a fair allowance.

Accordingly the time lost, by probably remediable causes, is :—

On Evan Hall	5·5 days	equal	5·91 per cent.
,, Belle Alliance..	5·0 ,,	,,	4·85 ,,
,, New Hope	14·5 ,,	,,	17·95 ,,

It having been found necessary to stop to windrow, it is fair to assume that the quantity of cane windrowed was in direct proportion to the size of the various crops. It, therefore, follows that the time lost by remediable causes, is in direct proportion to the relation existing between the factors of the above table.

Much attention should be given the application of methods of delivery of cane, which would facilitate the continuous running of the sugar houses.

The writer has had occasion to estimate the relative cost of a sugar-house, when all departments were working, and when only the boiling house was operated, as on Sundays. The result of this estimate shows that the cost of running the boiling house only, is fully 75 per cent. of the cost when every department is working its full capacity. Hence, it follows that unnecessary stoppages are the most fruitful causes of unprofitable manufacturing expenses.

Mill Time.

For the days on which the mills ground cane the average running time was :—

	Hours.
On Evan Hall	22 25-60
,, Belle Alliance	22 40-60
,, New Hope	22 15-60

Allowing 35 minutes each day to oil machinery, wash mills, etc.. from the above, it follows that the daily lost time was :—

	Hours.
On Evan Hall	1 00-60
,, Belle Alliance	0 45-60
,, New Hope	1 10-60

These minor daily losses, although apparently unimportant, amount to several days by the time the season ends. According to the detailed account of the cause of each stoppage at Evan Hall, 53·74 per cent. of the above daily loss was due to avoidable causes, and 46·26 per cent. to necessary repairs. It is not to be presumed, that the Evan Hall machinery was in such condition as to require fewer repairs than the other places. Hence, by dividing the lost time of each place, according to these proportions, and multiplying same by the number of days, during which the mills ran, the average unnecessary daily loss of time gives the following totals for the season, viz. :—

On Evan Hall	37 50-60 hours,	about	$1\frac{3}{4}$ days.
,, Belle Alliance	31 35-60 ,,	,,	$1\frac{1}{2}$,,
,, New Hope	28 30-60 ,,	,,	$1\frac{1}{4}$,,

From data collected during the past seasons, doing good work: namely, extracting from 75 to 79 per cent. of juice from the cane, the mills are found to have the following average daily capacities :—

	Tons.
Evan Hall's	500
Belle Alliance's	375
New Hope's	575

With the exception of New Hope, actual experience has repeatedly shown the mills doing good work when grinding the full quota of cane allotted.

It is generally believed that the New Hope Mill can grind the cane, but that the boiling house is inadequate to the requirements of 500 tons per day.

In due course the writer will attempt to show in what way, by careful watching, he believes the New Hope house, as a whole, capable of handling 500 tons of cane per day.

Returning to the subject under discussion, according to the preceding table of capacities, the loss of time resulting from not grinding a sufficient quantity of cane, is :—

	Days.
On Evan Hall	$9\frac{1}{2}$
On Belle Alliance	0
On New Hope	$9\frac{3}{4}$

Summarizing all that has been said of unnecessary lost time, even with the average running time per day remaining the same, we find a total loss of 15 days, or 16·09 per cent. at Evan Hall, 5 days or 4·85 per cent. at Belle Alliance, and 24¼ days or 37·20 per cent. at New Hope. Attention having been already called to the fact that when no cane is ground, the running expenses of a sugar house are only reduced by about 25 per cent., it follows from what precedes, that if no time had been lost, the total expenses of running each house would have been reduced by the following proportions, viz:—

	Per cent.
Evan Hall..	12·06
Belle Alliance	3·64
New Hope..	18·19

It is true that, owing to its crooked condition, cane at Evan Hall was very hard to handle, but it must not be forgotten that the same conditions existed at Belle Alliance. Unless it can be shown that with the raw material handled, the results of New Hope and Evan Hall exceed those of Belle Alliance, by at least the same ratios as the excess in cost, there remains nothing but the hope that in the future, by closer attention to all details, Evan Hall and New Hope will attain the high degree of rapidity, which characterises Belle Alliance's work during the season of 1890.

Milling.

The records show the following general averages for juice extracted from the cane ground:—

	Per cent.
On Evan Hall	77·21
On Belle Alliance	76·38
On New Hope	75·05

In every instance, these are the highest general averages ever noted. It is believed that this superiority of work over previous seasons, is mainly the direct result of the use of Mr. Riley's excellent force feed on the back mills of each place. By means of this appliance the feed is so regulated as so prevent choking, and all the attendant evils of irregular feeding.

The improvement in extraction is greatest at New Hope, where, in 1889, the extraction was only 71·54 per cent., which shows an improvement of 4·89 per cent.

To be entirely fair, and without in any way disparaging, the merits of the "Pusher," it must be said, that some of the improvement noted is also due to the better condition of the New Hope mill.

Although gratifying, as far as it goes, it must not be forgotten that New Hope's mill extraction is still susceptible of improvement. On several runs the extraction exceeded the above general average, and in one instance reached 78·84 per cent.

Believing that a thing once accomplished can be repeated, it is hoped that with the experience gained during the past two seasons, New Hope will, on a general average, show as good milling results as those of its neighbours. In this way its present 1·74 per cent. inferiority in extraction to Belle Alliance, and 2·78 per cent. to Evan Hall will disappear.

Normal Mill Juices.

According to their composition and sucrose content, as shown in the special reports, the Belle Alliance mill juice is found to have been 6·39 per cent. superior to Evan Hall's, and New Hope's 6·72 per cent. better than Belle Alliance's, and 13·53 per cent. richer than Evan Hall's.

Sulphuring.

After reducing the sulphered juices to terms of the corresponding normal juices, the figures show no inversion at Evan Hall, 0·18 per cent. of the sucrose contained in the normal juice at Belle Alliance, and 0·08 per cent. inversion at New Hope.

Compare with 1889, the inversion noted at Belle Alliance is seen to have been reduced by 52·63 per cent. of itself, and is, no doubt, the result of more care being exercised in handling the juices and sulphur fumes. For the same reasons a still greater reduction is noted at New Hope, where the reduction amounts to 91·11 per cent. This seems to indicate that by the adoption of the suggested changes in the sulphur machine, and in the manner of handling the sulphured juices, and the addition of lime at the mill, some little advantage was gained. With a little more care in the details of handling, probably by the addition of a little more milk of lime at the mill, the writer believes that even the slight inversion of 0·08 per cent. would disappear.

On the basis of the results obtained by sulphuring on Belle Alliance in 1888, the inefficacy of this process during 1890, was :—

	Per cent.
On Evan Hall	8·63
On Belle Alliance	12·34
On New Hope	27·20

These results may be purely accidental, yet there is no doubt that

since, in 1888, sulphuring produced a beneficial effect in purifying the Belle Alliance juices, there existed at that time certain conditions of work which were never repeated, and only approximated at Evan Hall during the past season. Whatever they may be is, for the present, a mystery, which, in the future, may or may not be solved. It cannot be said that the superior results referred to were due to the very rich juices, for, during the past season, the poorest juices were those which responded best to the process of sulphuring, which process was, to all outward appearances, identical in each case.

Clarification.

In one respect the results of this process show an improvement over 1889. Where no inversion can be detected for 1890, during the previous season, a 0·09 per cent. was detected at Evan Hall, 0·08 per cent. at Belle Alliance, and 0·07 per cent. at New Hope. As to the general results of clarification, including sulphuring, and on the same basis of comparison the work of all three places has fallen below the assumed standard. The degrees of inferiority being as follows:—

	Per cent.
Evan Hall	13·85
Belle Alliance	16·00
New Hope	22·67

For the crop of 1890 alone, as is evidenced by the decrease of glucose to sucrose ratio, and the larger increase of the purity coefficient, when compared with the sulphured juice, the clarification proper, at New Hope, was certainly more effective than that of the other places.

But, according to the above table, the general results are found inferior, since a smaller quantity of impurities than could be expected were removed from the raw juice.

Evaporation to Syrup.

According to the special reports no inversion can be detected in this stage. From this standpoint the work of the Double Effects, both at Evan Hall and Belle Alliance, was quite as satisfactory as for 1889. At New Hope it was a great deal more so, since, where now no inversion can be detected, a 0·60 per cent. inversion is charged against 1889. Although a certain proportion of the syrups coming from the Triple Effect was reheated, as in the past season, this operation seems to have been attended with so much more care, that no inversion can be traced. Provided that the same care can be exercised in the future, the writer believes that the advantages to be derived from

re-heating and brushing syrup recommend the practice even without a cooler. Greater safety, however, would be obtained by the rapid cooling of syrup after re-heating and brushing. As will be shown later on, greater care was exercised in the working of the double and triple effects, and the mechanical losses for 1890 are very much smaller than for 1889. These evaporators can be said to have given more satisfactory results than heretofore, although still susceptible of much improvement.

Evaporation to Masse Cuite.

During this process no inversion can be detected, either at Belle Alliance or New Hope, and this shows a marked improvement in the work of both houses. In 1889 a 0·95 per cent. of sucrose in the mill juice was inverted at Belle Alliance, and 2·42 per cent. at New Hope. The contrary is the case, however, at Evan Hall. Where no inversion could be detected in 1889, a 0·69 per cent. inversion is detected in the work of 1890. In the special Evan Hall report, it was suggested, that this inversion might be due to stiffer masse cuites. The fact, that New Hope's masse cuites contain somewhat less moisture than those of Evan Hall, does not seem to support this theory. On the other hand, although the number of square feet of heating surface in the pans are about the same, it is possible, that owing to a difference of coil construction the circulation of the Evan Hall vacuum pan may be inferior to that of New Hope. This is a point, however, upon which no hasty conclusions should be drawn, and it is hoped that future investigations may reveal the real cause of the Evan Hall inversion.

(To be continued.)

NITROGENISED BONE BLACK.

Purification of Saccharine Liquids by Nitrogenised Charcoal.

M. Lagrange, Director of the Central Laboratory at the Paris Bourse du Commerce, has been making experiments on the action of pure azotised charcoal on sugar syrups, and has ascertained that this substance has the property of rapidly absorbing the whole of the colouring matters, the whole of the lime and the organic compounds of lime, as well as a large proportion of the albuminoid and pectic substances. M. Lagrange prepares the nitrogenised charcoal by putting fine bone black (animal charcoal) into a bath of chlorhydric

acid free from sulphuric acid. The mixture is stirred, and left to settle, then decanted, and the charcoal is washed with water rendered slightly alkaline. The inventor applies the azotised charcoal, in the manufacture of sugar, to the treatment of the syrup issuing from the triple effect. The syrup, of 18° to 20° Baumé, passes into a vat furnished with a mechanical agitator. The necessary quantity of azotised charcoal is then added. The mixture passes through a series of cylinders supplied with agitators and heating coils, which effect a perfect combination at a temperature of 60° to 70° C. The mixture drawn off from this battery is filtered. The char which is separated is revivified either by wet or dry process. In sugar manufacturing, the use of azotised charcoal results, according to the inventor, in the production of white masses-cuites with a considerably high yield, and will allow of the cure in a granulated form of the runnings of the first strike, which will enormously diminish the weight of molasses.

In refining, the treatment with the azotised charcoal is said to be the natural complement of the Steffen process. The procedure would be as follows:—Clearing of the raw sugar; melting of the sugar at 90°; purification by the pure azotised charcoal; the regular clarification, and filtration. But the cleare, in place of going to the charcoal filters in grain, would go direct to be cured in the fine grain.—*Journal des Fabricants de Sucre.*

EXPORTS FROM THE COLONIES FOR TWELVE MONTHS ENDING AUGUST 31ST, FOR FOUR YEARS.

(From Licht's Monthly Circular.)

	1890-91. Tons.	1889-90. Tons.	1888-89. Tons.	1887-88. Tons.
Havana & Matanzas..	350,061	262,421	247,665	331,703
Portorico	51,114	59,634	54,886	62,506
Trinidad	44,790	47,870	52,306	63,367
Barbados	59,547	71,173	62,656	66,108
Martinique	32,052	36,022	36,325	40,009
Guadeloupe	32,377	47,527	45,016	50,094
Demerara	108,638	116,114	115,619	97,224
Pernambuco	172,189	109,169	122,807	168,281
Java	429,693	331,951	411,315	432,675
Philippine Islands	170,147	116,175	264,602	169,529
Mauritius	124,652	123,985	128,917	121,508
Reunion	39,410	36,375	25,418	32,031
Total, 12 months..	1,604,344	1,358,423	1,567,672	1,646,890

It will be noticed that the figures for Jamaica, Antigua, St. Domingo, and Hayti, a portion of Brazil, Peru, and the Sandwich Islands are not given.

NOTICES OF BOOKS

KING'S HANDBOOK OF THE UNITED STATES.*

One of the most handy, attractive, and useful publications of the kind that we have ever seen, bearing the above title, has just been published by the Moses King Corporation, Buffalo, N.Y. It is a well printed and most readable octavo volume of over 900 pages, profusely illustrated with small but neat engravings of public and commercial buildings of interest, and a perusal of several portions has caused us to regret the absence of anything so attractive and instructive, and at the same time so portable and useful, as a volume of reference for our own country. Nearly all that is wanted by the general reader is to be found within the covers of this book, though naturally much that is interesting relating to such a vast country has had to be omitted, and we occasionally miss the mention of some very prominent business undertaking where others not quite so important are named. Thus we are not a little surprised that the "grand circle of plantations and sugar-houses" (as they have been called) belonging to the Mc.All Bros. Plantation and Manufacturing Co. have been omitted in the Louisiana section; and again, while Claus Sprekels' Refinery at Philadelphia is duly mentioned, the great Brooklyn Refinery of Havemeyers & Elder passes unnoticed. More space should also have been given to the Pittsburgh Iron-Foundries and to Chicago meat-packing establishments. We hope the volume will find a wide circulation wherever the English language is spoken or understood. We have thought that the best way to fairly introduce the book to our readers would be to give the following rather lengthy extracts from the portion relating to Louisiana, which most interests us as the editor of a sugar journal:—

"Sugar raising supports half the population of Louisiana, employing $90,000,000 in land and buildings, and yielding $25,000,000 a year. Along the thirty leagues of bottomless alluvion, extending from New Orleans to Baton Rouge, extends a long succession of sugar plantations, before the war the scene of a patriarchal and luxurious life. The illimitable green sea of cane and rice fields is broken only by dark groves of live-oaks and magnolias; the broad and low mansions of the planters, wide

*King's Handbook of the United States. Planned and edited by Moses King. Text by M. F. Sweetser. Over 2,600 illustrations; 51 coloured maps. Buffalo, N.Y. Published by Moses King Corporation, 1891.

verandaed and spacious; and the mills and stables and negroes' cabins of each little independent community. In 1861 there were 1,400 plantations, occupied by 150,000 people, and producing in that year 460,000 hogsheads of sugar. Four years later the war-devastated State yielded but 10,000 hogsheads. The crop of 1890 was the largest since the war, reaching 330,000 hogsheads of sugar and 500,000 barrels of molasses. The product is from 20 to 30 tons of cane an acre, 90% being juice, of which 15% is sugar, so that each 100 pounds of cane holds 13½ pounds of sugar. The Act of Congress passed in 1890, giving a bounty of from 1¾ to 2 cents a pound on all sugar of a certain grade produced in this country, has had a stimulating effect on the industry.

"Down near Houma, in the far-extending delta parish of Terrebonne, is the great Southdown plantation, covering 5,000 acres, formed by a union of older estates, and for many years under the direction of Henry C. Minor, an old and experienced sugar-planter, whose father founded the original Southdown in 1827. The wonderfully rich soil of this section produces sugar-cane of the best quality, and in large and profitable crops. For the manipulation of this valuable product Southdown has a costly and efficient sugar-house, a refinery, and other needful adjuncts, and employs 150 hands. The yearly product is 3,000,000 pounds of sugar and 2,000 barrels of molasses, from cane grown on the estate, and through all the vicissitudes of the sugar business this plantation has never gone behind in its operations. The plantation is contiguous to the railroad and the steam-boats plying up and down the winding Bayous. The parish in which Southdown stands was settled over a century ago by Acadian refugees from Nova Scotia, and their descendants still inhabit these rich and beautiful lowlands.

"Shady-Side Plantation is away down in the Delta, near Centreville, in St. Mary's Parish, and covers 7,000 acres (more than a third of which is under cultivation), being a consolidation of four old-time plantations. It is owned and conducted by John Foos, and James W. Barnett, two Ohio men, who invested down here in 1870, and have since established one of the largest and best-equipped sugar estates in the South. The sugar-house at Shady Side is an enormous structure, built in 1889 from carefully studied plans, fitted with all the valuable machinery used in the most advanced modern processes of refining, and capable of a very large output. It is the largest plantation

sugar-house in the Bayou-Teche country, and one of the best equipped in the State. Many interesting experiments have been carried on at Shady Side, as to using bagasse to make pulp for the manufacturing of paper, and in other directions, applying the well-known ability and ingenuity of Ohio men to enlarging the resources of Louisiana. Mr. Foos still retains his home and enterprise in Springfield, Ohio; but Mr. Barnett moved down to the plantation in 1870, and has ever since devoted himself with the industry and business methods of the North to the utilization of the immensely productive plantations of the South. In all the surrounding country Mr. Barnett's name is synonymous with good friendship hospitality and generosity combined with an exceptionally successful financial undertaking.

"The famous Calumet Plantation, on the banks of Bayou-Teche, near Pattersonville, in several respects leads the world of American sugar estates. Its proprietor, Daniel Thompson (a native of Maine, and long-time resident of Chicago), was by some twelve years Louisiana's pioneer in the use of commercial fertilizers. He was by 16 years the first private individual in Louisiana, and probably by ten years the first in the world to introduce the chemical laboratory, for agricultural research upon a sugar-cane estate. Wibray J. Thompson, his son, was by four years the pioneer of the United States in the introduction of chemical and physical investigations directly applied in the actual conduct of manufacture, being for that period the sole scientist engaged in this field in America. The experimentation with fertilizers led from the first to a practice, the wisdom of which subsequent investigations elsewhere have confirmed; while those in the factory have produced practical industrial results, which had been believed altogether impossible. These gentlemen are also now the first and only private parties in the world engaged in the scientific development, by seed-selection, of the sorghum plant, by which, as an auxiliary crop to tropical cane, they hope eventually to double the period of manufacture, which does not now exceed 60 days a year. Their success in this, to date, has been phenomenal. The chemical, mechanical and and financial controls, particularly the last two, are without parallels for completenes and scientific value in the world's cane-sugar industry. The results of their work have been published from the first, for the benefit of all others engaged in sugar production, and the plantation is known wherever sugar is made. The exceptionally fine record made by the Calumet shows a continuous development of product, and

whereas in earlier days from 80 to 110 pounds of sugar were obtained from a ton of cane, now 200 pounds are extracted. Most of this advance has come since 1880, and it is expected that the intricate experiments continually in progress here will achieve still higher results. This beautiful and notable plantation covers 6,000 acres, and its management combines Northern industrial methods and business organizations with Southern hospitality and sympathy.

"Among the Northerners who have become identified with Louisiana since the close of the 'late unpleasantness,' and have borne a prominent part in building up its industries, are the Ames family, of Massachusetts, so well and widely known—Oakes A., Oliver, and Frank M. Ames, the heirs of the Oakes Ames, to whom this country is so much indebted for its railroad development. They are the owners of one of the largest estates in this land of broad domains, covering 13,000 acres, in the parish of Jefferson, directly opposite the city of New Orleans, their property having a river-front of two miles. The domain includes, among others, the South Side and Estelle Plantations, formerly known as the Millaudon Plantations. Their land is traversed by the Southern Pacific and Texas and Pacific Railways, with a station at Amesville. They were among the first to introduce the modern methods and appliances for the cultivation and harvesting of the crop, and the equipment is among the best and most efficient in the State. They have six miles of permanent and portable railroad tracks; and introduced the car for handling sugar cane, which has come into general use in all sugar-raising countries, and has been of great benefit to planters. They were among the first to use commercial fertilizers, and to introduce methods by which actual information as to results might be obtained. Their private or protective levee is over seven miles in extent, and by it they were enable to protect their cultivated land from the overflow of 1884, which was so disastrous in its results. The capacity of the sugar-house (which is in plain sight from the city of New Orleans) is from 60,000 to 70,000 pounds of sugar a day, or about 5,000,000 pounds during the sugar-making season. Their crop in 1891 exceeds 3,000,000 pounds, all of which goes to New Orleans.

"The Louisiana Sugar Refinery is the largest in the Southern States, and covers three entire squares of ground on Custom House and Decatur Streets, New Orleans. This mammoth establishment has the most modern and ingenious machinery, and can turn out

1,250,000 pounds of sugar daily. It receives the plantation sugars of Louisiana, Cuba, and the Sandwich Islands, besides large quantities of beet-sugar, and produces therefrom all grades of refined sugars and syrups, which find a market all over the United States. About 750 men serve this corporation, whose yearly pay-roll exceeds $350,000. The Louisiana Refinery is under the presidency of John S. Wallis, and dates its origin from the year 1883. It is one of the commanding industries of New Orleans, and its products are unexcelled for their excellence and standard merit. The Planters' Refinery a few years ago came under the same ownership as the Louisiana Refinery.

"Down in the rich and beautiful Gulf parish of St. Mary's, and close to its shire-town Franklin, stand the immense new buildings of the Caffery Central Sugar Refinery, erected after the designs of Sully and Toledano, the New Orleans architects, and fully equipped with all the modern machinery and inventions used in the processes of refining sugar. The Caffery plant has been constructed with unusual care and solidity, and shows the best results of modern scientific processes as applied to this important industry. The transportation of the product of the plantations to and from the refinery is made easy by spur-tracks running from the Morgan line of railway into the works. The owner of this notable new enterprise is John A. Morris, one of the best-known of Louisiana's millionaires, who has invested $600,000 in this bold venture. The introduction of the Caffery Refinery is destined to work a revolution in the business throughout the Gulf parishes. The cane ground here is brought from the small farmers in the neighbourhood and along the railroad, and the great success of this institution demonstrates that central sugar-houses are desirable, and many more will be built. The capacity of the plant is 500 tons of cane a day. Thomas Sully is the general manager of the refinery.

"Another interesting phase of this business is seen in the case of the men who are at once active sugar factors or commission merchants and owners of great plantations. Foremost amongst them is Richard Milliken, the owner of several plantations, all of which are large producers of sugar. He has been famous for many years for his liberality in advancing money on growing crops. His financial foundation was of so solid a character that even the costly experiences of the bad seasons of 1878-9 and 1882-3 failed to shake

his high credit; and to this day he has remained actively in the field in intimate connection with the foremost sugar-planters of Louisiana, and wielding a powerful influence in the development of this valuable industry. It is said that as a factor or broker he has handled more sugar than any individual in the South. In 1840, after he had been a resident of New Orleans for eight years, Mr. Milliken became a sugar broker, and carried on this business with remarkable success until 1887. He handled one-third of the sugar crop of Louisiana. In 1870 he became also a sugar factor, and has since handled one-fifth of the crop, or 40,000 hogsheads of sugar and 60,000 barrels of molasses yearly. In 1872, Mr. Milliken acquired the Unity plantation, in 1876 the Waterford, and since then the Fairfield, Killana, and Cedar Grove estates. The Milliken plantations employ 1,000 men, and have a yearly product of 5,000,000 pounds of sugar and 300,000 gallons of molasses."

Sul Peso Normale pei Saccarimetri. By R. Nasini and V. Villavechia. Rome: 1891. Tipografia Nazionale di G. Bertero, Via Umbria.

The title of this pamphlet of 54 pp. royal 4to, "On the Normal Weight in Saccharimetry," sufficiently explains its subject. The authors are the chemists officially attached to the "Laboratorio Chimico Centrale delle Gabelle (Excise)" at Rome, already favourably known to the commercial and scientific world by publications on sugar and other matters in 1888 and 1890. The introduction informs us that in July, 1886, when the Laboratorio commenced its operations, it was suddenly called upon to establish a method of analysis for the raw sugars which, by the law of April 2nd of that year, were allowed the benefit of a drawback. Amongst the various questions to be considered was that connected with saccharimetry; whether the German or the French normal weight should be adopted, and whether, in the event of the latter being chosen, the old normal weight should be adhered to, or the new one established by Girard and De Luynes. The Laboratorio thought it advisable to adopt the German system, without at the time entering into the knotty question of the normal weight. The authors came eventually, after careful study, to the conclusion that the normal weight proposed by Girard and De Luynes could not be considered as exact, and we have here a synopsis of their experiments, which they offer as a contribution to the settlement of

the vexed question of the proper normal weight to be used. They appear to have gone to work in a thoroughly methodical and regular way, and to have experimented at the outset on more than 80 samples of very various sugars, which they subjected to a process of scientifically conducted refining, obtaining eventually absolutely pure sugars, so as to guarantee the most perfect accuracy. The results obtained are put in a very clear and thoroughly intelligible form, and for everyone interested in the question, who is acquainted with the Italian language, must form a most valuable, perhaps almost indispensable book of reference. The typography and execution of the illustrations leave nothing to be desired.

Correspondence.

To the Editor of "The Sugar Cane."

Sir,—We wish to draw attention to the extraordinary apathy displayed by the West India sugar planters and their families in using refined *beet* sugar instead of always insisting that all the refined sugar they use should originate from the cane, and the cane only (guaranteed as such). We believe that every ounce of refined sugar now used in the West Indies is made from "beet" or a mixture of beet and cane. This seems extraordinary when "pure cane" refined sugars can so easily be had if people would only take a little trouble and insist on having nothing else. In Great Britain the same thing happens; the public use what the grocers give them as the "best sugar," "pure sugar" (omitting the word "cane"), &c., but we feel sure that if the public could be once taught to always insist on having "cane" sugar (both raw and refined), and to see that they got it, they would soon appreciate the greater sweetening power, purer taste and smell. Everyone connected with the West Indies should feel it his or her duty to point this out to their friends, &c.

Apologising for troubling you,

We are, sir, yours, &c.,

James Philip & Co.

(Pure Cane Sugar Co.)

4, Fenchurch Buildings, London, E.C.,
15th October, 1891.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; 63, Long Row, Nottingham; and 323, High Holborn, London.

ENGLISH.

16464. Duncan Stewart, Glasgow. *Improvements in apparatus for extracting juice from sugar cane.* 29th September, 1891.

17274. R. W. Deacon, Liverpool. (Communicated by W. Maxwell, Java.) *Improvements in multiple effect apparatus for evaporating or concentrating sugar juice and other liquids.* 10th October, 1891.

GERMAN.

Abridgments.

55453. Julius Schwager, Berlin. *Surface evaporator.* 4th March, 1890. (Addition to Patent No. 53,045, of the 23rd August, 1889.) In order to moderate the acceleration which gravitation exerts on the downward movement of and to reduce the force of the stream of liquid, the heating pipes are widened out towards the bottom part of the apparatus.

55454. W. Wild, London, and A. S. Oesterreicher, in Laibach, Krain. *Evaporating apparatus.* 2nd July, 1890. The liquid under treatment first enters the feed heater, and passes from thence through a pipe to a coil surrounding the heater. The latter widens out gradually towards its lower end in order to diminish the speed of the liquid passing through. A separator is fixed at the end of the heating coil for the purpose of condensing the liquid bubbles arising in the waste steam.

55460. Julius Schwager, Berlin. *Surface evaporator.* 23rd July, 1890. (Second addition to Patent No. 53,045, of the 23rd August, 1889.) For the first addition, see above, No. 55,453. A number of pipes is removed from the evaporator forming the object of the principal patent, and the space so obtained is connected by means of a pipe with a chimney, ventilator, or other suitable suction apparatus. The jacketting of the pipes mentioned in the principal patent is also no longer required.

55797. T. Gaunt, Brooklyn, State of New York, U.S.A., and E. H. Clapp, Boston, State of Massachusetts, U.S.A. *Improved feed*

arrangement for evaporating apparatuses. 20th November, 1888. The liquid to be evaporated enters through a pipe and valve into the feed arrangement adjoining the evaporating apparatus. The valve is actuated by a weight and likewise by a hollow vessel actuated by its own weight, which vessel is, by means of a flexible pipe, placed in connection with the interior of the feed apparatus. Now if the liquid rise proportionately in the feed apparatus and hollow vessel, the latter overbalances the weight of the valve, in consequence of which the valve closes and the entrance for the liquid is shut off. If, on the contrary, the liquid fall in the feed apparatus, the liquid being discharged through a pipe fixed in the bottom of the apparatus into the evaporator, the weight counteracts the influence of the hollow vessel and the valve is in consequence opened.

55910. Fr. Rassmus, Madgeburg. *Improved knife-box applicable for a shredding machine.* 18th March, 1890. The inclined lower knife can, by means of an adjusting screw, be set against the upper knife. In like manner the rest is also arranged so as to be adjustable.

55922. Herm. Koch, Halle-on-Saale. *Improved process for treating pulverised coke, so as to increase its efficacy as a decolouring, or bleaching medium.* 13th March, 1890. About three parts of easily dissolved caustic alkali or even carbonate of alkali is melted, and two parts of ground coke, *e.g.*, brown coal coke added while stirring to the fluid mass, and the mixture is kept about 20 minutes under constant stirring at red heat, the molten mass is then pulverised and the alkali washed out with hot water. The pulverised coke which is still alkaline is acidfied with weak hydrochloric acid, again washed out up to neutral re-action and dried. By means of this new preparation, for example, the drainings of tar distilleries, drain refuse as well as melted paraffin may be completely bleached. The melting by means of alkaline probably removes silicate which coats the carbon in the coke and in consequence of this its action is rendered more complete.

55868. A. H. J. Berge, Brussels. *Improved process for converting amylaceous substance into gum or dextrine.* 27th April, 1890. The amylaceous substances are heated until perfectly dry in an atmosphere of sulphurous anhydride at a pressure of 120 to 190 degrees centigrade, according as to whether the gum is to be soluble only in hot, or also in cold water. The pressure can be raised by pumping in sulphurous acid or any other gas. After the starch has been converted into

gum, the sulphurous anhydride is allowed to escape from the autoclave, in order that the same may be emptied and used again.

56110. R. BERGREEN, Roitzsch, near Bitterfeld. *Improved shredding press.* 13th May, 1890. In this apparatus there are two cylinders, the one an eccentric one revolving within the other, in this way the shreddings after being well pressed in chamber 1 are conveyed through openings which are made in the intermediate floors to chambers 2 and 3 respectively in order to be further pressed. For the purpose of regulating the pressing, pins are used, which can be pushed forward the distance required into the interior of the press chamber.

56466. E. PECHNIK, Grosz-Peterwitz, near Ratibor; C. BÖGEL, Brieg, Reg-Bez. Breslau; and SIGMUND STEIN, Grosz-Peterwitz, near Ratibor. *Improved process for purifying sugar solutions by means of peroxide of hydrogen.* April 22nd, 1890. The syrup and molasses containing lime are treated with 1/20 to 5 per cent. peroxide of hydrogen in solution, and then with phosphoric acid and magnesia, and they are then separated from the precipitate which is thereby formed. The sugar solutions purified in this manner are used for casing raw sugar, and the syrups draining from same are employed for treating other saccharine liquids instead of the peroxide of hydrogen solution. The solution is also further treated with salicylic acid in order to avoid loss of sugar in this process caused by decomposition.

56311. HERM. UNGER, Magdeburg. *Evaporating apparatus.* 19th June, 1890. The steam which surrounds the heating pipes is conveyed to the same through the supports of the apparatus. The juice to be evaporated enters by means of a suitable opening into a chamber, from here it rises within this circular chamber or space between two heating pipes fixed one within the other, and then falls down on the inner of these heating pipes. The ends of the pipes are arranged so as to allow the juice to trickle down in as thin a layer as possible.

56531. FIRMA H. HOTTMAN & Co., Bochum. *Apparatus for boiling, evaporating, drying, and cooling solid or fluid bodies.* 18th June, 1891. This apparatus consists of two rotatable vessels placed one within the other. The inner vessel takes up the material to be treated and is supplied from its axle, and air is exhausted from the same by means of an air pump fixed to the apparatus. Suitable

means are provided for admitting the heating or cooling medium into the space between the inner and outer vessel.

56267. RUDOLPH BERGREEN, Roitzsch, near Bitterfeld. *Apparatus for supplying shredding machines with sugar cane.* 31st May, 1890. The shredding knives are fixed in a frame with a to and fro movement, actuated by a crank. The cane is fed to the machine by means of rollers. Suitable apparatus is provided for pressing the cane against the knives, thereby securing the perfect action of the cutting apparatus.

56549. MATTHAEUS MANNCHEN, Heppenhein, a.W. RHEINHESSEN. *Apparatus for cutting beetroot and the like.* 11th October, 1890. Two knives are fixed upon a curved support, and are drawn downwards by means of a foot-board, connecting rod, and lever, thereby bringing the same into contact with the roots laid upon the receiver. When the pressure is removed from the foot-board, the support to which the knives are fixed resumes, by means of a counterweight, its original position.

56717. SANGERHAUSER ACTIEN-MASCHINENFABRIK UND EISENGIESSEREI, formerly Hornung & Rabe and Ernst Schulze, Sangerhausen. *Shredding machine for sugar cane and the like.* 28th October, 1890. A number of conical shredding cylinders are fixed to a shaft, which is provided with a loose running sheave. A special hopper conveys the material under treatment to each set of shredding cylinders. The lower part of the discharge end of this hopper lies parallel with the working surface of its respective cylinder.

56867. L. WULFF, Schwerin i. Mecklenburg. *Improved process for reducing sugar juices to a crystalline condition.* 29th July, 1890. The undiluted centrifugalled syrup in the centrifugals, together with the crystallised product contained in the same from previous boilings, is, after the rob has ceased to be conveyed into the vacuum, also subjected to the vacuum, in order to dilute the masse-cuite and again set free the crystallised product. Should the diluted syrup collect too rapidly, a portion, after the crystallised product has settled, is removed and used for the boilings down of an after-product, while the settlings are conveyed to the vacuum apparatus.

56364. JULIUS SCHWAGER, Berlin. *Improved conical filter.* 29th May, 1890. The filter surface of this filter is formed of several sieves of a concentric and partly tapering shape, which alternately come

into contact with one another above and below. This arrangement permits of relatively very large quantities of liquid being filtered with a very small fall. The sludge deposited during filtration collects in a funnel with a discharge pipe, and can, with the help of two slides placed over one another, be removed without interruption to the filtering process. The liquid enters through one pipe and is discharged by another. An upper pipe serves for the discharge of the air at the beginning of the operation, and another for admitting the air during the emptying of the discharge pipe.

56415. K. W. Grashoff, Magdeburg. *Improvements in continuous working centrifugal machines for sugar masse cuite.* 22nd July, 1890. The conical shaped drum casing hitherto in use for continuous working centrifugal machines is not very well adapted for centrifugalling sugar masse cuite, because the latter leaves the drum so rapidly that no time remains for the separation of sugar and syrup. In order to avoid this evil and prolong the discharge of the sugar masse cuite, the drum is provided with a contracted ring, which consists of one perforated ring or several circular sieves laid over one another.

56557. Rudolph Bergreen, Roitzsch, near Bitterfeld. (Addition to Patent No. 50067, 15th March, 1889.) *Improvements in knives for shredding beetroot, &c.* 8th September, 1889. The knife protected under Patent No. 50067 is combined with a knife with a flat surface which tapers towards its upper part. The smooth under surface of this latter knife serves for conveying the shreddings formed by the action of the two knives.

56886. J. Fischer, Vienna. *Evaporating apparatus.* 5th August, 1890. Flaps provided with shovels or scoops are fixed to a rotating shaft. These scoops serve for raising the liquid to be evaporated from the underneath part of the evaporator and conveying it by means of obliquely fixed ribs throughout the whole apparatus to the discharge opening. The evaporator is provided with suitable heating apparatus.

IMPORTS AND EXPORTS (UNITED KINGDOM) OF RAW AND REFINED SUGARS.

JANUARY 1ST TO SEPTEMBER 30TH.

Board of Trade Returns.

IMPORTS.

RAW SUGARS.	QUANTITIES. 1890.	QUANTITIES. 1891.	VALUE. 1890.	VALUE. 1891.
	Cwts.	Cwts.	£	£
Germany	4,899,470	4,402,336	2,953,419	2,740,168
Holland	358,940	336,674	207,697	207,820
Belgium	655,288	532,723	364,960	316,860
France	919,171	1,128,185	570,491	747,485
British West Indies & Guiana	1,096,771	833,067	828,892	655,989
British East Indies	539,002	805,346	278,225	461,858
China and Hong Kong	....	....	....	....
Mauritius	180,039	202,087	114,939	124,001
Spanish West India Islands	38,000	19,935	28,500	15,699
Brazil	315,431	407,816	191,495	246,704
Java	871,658	1,739,037	619,339	1,182,425
Philippine Islands	228,033	757,602	120,568	403,589
Peru	491,268	305,117	331,179	213,024
Other Countries	281,800	450,223	201,650	304,590
Total of Raw Sugars	10,874,871	12,000,148	6,811,354	7,620,207
Molasses	592,852	399,594	171,392	122,740
Total Sugar and Molasses	....	....	12,897,595	14,332,105
REFINED SUGARS.				
Germany	3,617,680	4,677,691	2,922,791	3,807,803
Holland	1,372,486	1,261,292	1,142,058	1,067,100
Belgium	108,320	114,242	97,680	101,535
France	1,897,614	1,391,128	1,543,963	1,151,422
United States	245,304	531,918	204,805	446,816
Other Countries	4,236	17,969	3,552	14,482
Total of Refined	7,245,640	7,994,240	5,914,849	6,589,158

EXPORTS.—REFINED SUGARS.

	1890.	1891.	1890.	1891.
	Cwts.	Cwts.	£	£
Sweden and Norway	48,336	63,359	35,676	48,350
Denmark	105,005	102,788	64,691	65,277
Holland	70,017	65,328	49,651	46,520
Belgium	22,599	18,390	15,691	12,881
France	4,762	501	3,104	393
Portugal, Azores, & Madeira	62,559	54,709	41,822	38,432
Italy	63,801	32,789	43,361	23,488
Other Countries	165,202	214,294	125,767	159,973
Total of Exports	542,281	552,158	379,763	395,320

IMPORTS OF FOREIGN REFINED SUGAR.

The following figures give the imports of foreign refined sugar for the month of September, 1891, compared with the corresponding month of the two preceding years, and the average monthly imports for the year compared with those of 1888, 1889, and 1890, distinguishing the quantities of "Lumps and Loaves" from "other sorts," and giving the separate imports from each country:—

Countries from which Sugar has been imported.	"Lumps and Loaves." Including Cut Loaf and Cubes.							"Other Sorts." Including Crushed Loaf, Granulated, Crystallized, &c.							Total.						
	Monthly Average.				Sept.	Sept.	Sept.	Monthly Average.				Sept.	Sept.	Sept.	Monthly Average.				Sept.	Sept.	Sept.
	1888	1889	1890	1891	1889	1890	1891	1888	1889	1890	1891	1889	1890	1891	1888	1889	1890	1891	1889	1890	1891
	Tons.	Tons.	Tons.	Tons.	Tons	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France.............	1686	2373	3053	2056	1245	1393	2439	4855	8596	7488	5751	5016	4163	2445	6541	10969	10541	7807	6261	5556	4884
Holland	3267	2294	3045	3193	982	1719	2765	2675	3354	4579	3792	2459	3967	4470	5942	5648	7624	6985	3441	5686	7235
Germany & Austria*..	1510	2573	2616	3115	1056	1447	2661	11729	13844	17483	22983	6326	6452	14935	13239	16417	20099	26098	7382	7899	17596
Belgium	622	827	363	362	456	312	55	227	225	238	272	125	186	103	849	1052	601	634	581	498	158
United States	8	..	126	113	..	563	..	157	42	1237	2842	11	3744	15	165	42	1363	2955	11	4307	15
Russia	..	23	..	..	..	..	..	1959	2015	..	93	567	..	..	1959	2038	..	93	567	..	..
Other Countries	1	239	..	..	55	..	..	2	355	23	7	..	145	..	3	594	23	7	55	145	..
Total	7094	8329	9203	8839	3794	5434	7920	21604	28431	31048	35740	14504	18657	21968	28698	36760	40251	44579	18298	24091	29888

* Including some Russian.

SUGAR STATISTICS—GREAT BRITAIN.

FOR THE FOUR PRINCIPAL PORTS.

To October 17th, 1891 and 1890.

In Thousands of Tons, to the nearest Thousand.

	Stocks 1891.	Stocks 1890.	Deliveries 1891.	Deliveries 1890.	Imports 1891.	Imports 1890.
London	37	22	240½	221	252	194½
Liverpool ..	39	46	240	218	225	177½
Clyde	7	13	151	168	131½	153⅓
Bristol	—	1	50½	51	49½	50½
Total ..	83	82	682	658	658	574

The above figures do not represent accurately, or to the full extent, the position and movements of sugar in the United Kingdom, as Hull, Leith, &c., are not included, there being no published returns for these ports.

SUGAR STATISTICS—UNITED STATES.

From Willett & Gray's Report.

For the four principal Ports. In Thousands of Tons, to the nearest Thousand. For September, 1891 and 1890.

	Stocks. October 1st. 1891.	Stocks. October 1st. 1890.	Deliveries. In September. 1891.	Deliveries. In September. 1890.	Imports. In September. 1891.	Imports. In September. 1890.
New York	43½	19	56½	46	43¾	37½
Boston	4	2	3½	15	3	12½
Philadelphia....	1½	—	30	31½	28¾	27
Baltimore	—	—	3	—	1½	—
Total	49	21	93	92½	77	77
Total for the year			1199	969	1221	979

NEW YORK PRICES FOR SUGAR.

From Willett & Gray's Report, October 15th, 1891.

Fair Refining.	96o/o Centfs.	Granulated.	Stand. A.	Stock in Four Ports.
Oct. 15, 1891.—3c.*	3 7-16c.*	4½c.	4 5-16c.	Jan. 1, 1891— 27,756 tons.
Oct. 16, 1890.—5 7-16c.	6c.	6⅝c.	6⅜c.	Jan. 1, 1890— 11,169 tons.
Oct. 17, 1889.—5⅜c.	6⅛c.	7¼c.	7c.	Jan. 1, 1889— 32,254 tons.
Oct. 18, 1888.—5⅝c.	6¼c.	7½c.	7¼c.	Jan. 1, 1888— 47,798 tons.
Oct. 20, 1887.—5c.	5 9-16c.	6 11-16¾c.	6 5-16c.	Jan. 1, 1887—102,279 tons.
Oct. 21, 1886.—4 9-16c.	6 3-16c.	5⅞c.	5 7-16c.	Jan. 1, 1886— 57,328 tons.
Oct. 22, 1885.—5 7-16c.	6⅛c.	6⅝c.	6 3-16c.	Jan. 1, 1885— 89,186 tons.
Oct. 16, 1884.—4⅞c.	5½c.	6¼c.	5¾c.	Jan. 1, 1884— 60,900 tons.
Oct. 18, 1883.—6¾c.	7 11-16c.	8⅜ 11-16c.	8¼c.	Jan. 1, 1883— 50,297 tons.
Oct. 19, 1882.—7⅜c.	8c.	9¼c.	8⅞c.	Jan. 1, 1882— 43,927 tons.

* Net Cash.

STOCKS OF SUGAR IN THE CHIEF MARKETS OF EUROPE ON THE 30TH SEPTEMBER, 1891, FOR THREE YEARS, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining 4 principal entrepôts.	TOTAL 1891.	TOTAL 1890.	TOTAL 1889.
90	32	70	38	2	14	246	213	319

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING 30TH SEPTEMBER, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining 4 principal entrepôts.	TOTAL 1890-91.	TOTAL 1889-90.	TOTAL 1888-89.
1396	536	507	299	59	383	3180	3101	2751

ESTIMATED CROP OF BEETROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE PRESENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1891-92.	1890-91.	1889-90.	1888-89.
	Tons.	Tons.	Tons.	Tons.
German Empire	1,280,000	1,331,965	1,264,607	990,604
France	850,000	694,037	753,078	466,767
Austria-Hungary	750,000	778,473	787,989	523,242
Russia	530,000	525,000	456,711	526,387
Belgium	195,000	200,000	221,480	145,804
Holland	50,000	61,307	55,813	46,040
Other Countries	75,000	80,000	80,000	87,000
	3,730,000	3,670,782	3,619,678	2,785,844

The new figures are given by Mr. Licht under all reserve, as some of the reports are very conflicting.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

The market opened last month with a great want of animation, the cautious policy of the past few weeks being maintained. This gave way in the second fortnight to a more active speculative feeling, consequent mainly on unsatisfactory reports from the Continent. This, however, was of comparatively short duration; more favourable reports of the beet crops, and a greater amount of sugar offering, reduced the market to what has been of late the normal condition of comparative inactivity.

A certain amount of excitement has been caused by the proposal to classify under two or three headings the numerous various qualities of granulated sugars. Should this take place, business will be unfavourably affected, as the classification of this article would enable speculators to deal with this part of the market, at their will, in a manner which is not now possible. The result of the negotiations, said to be in progress between America and Germany, will certainly affect the London market. Consumption, both in Europe and America increases steadily. Prices may be quoted as practically unchanged. Mr. Licht's new figures will be found on page 615.

Present quotations for the standard qualities, as under, are:—

			Last Month.
Floating.			
Porto Rico, fair to good Refining	12/9 to 14/-	against	12/9 to 14/-
Cuba Centrifugals, 97°/° polarization	14/9	,,	14/9
Cuba, fair to good Refining	13/- to 13/6	,,	13/- to 13/6
Java, No. 14 to 15 D.S.	15/3	,,	15/-
British West India, fair brown	12/3	,,	12/3
Bahia, low to middling brown	10/6 to 11/3	,,	10/6 to 11/-
,, Nos. 8 to 9	11/9 to 12/3	,,	11/6 to 12/-
Pernams, regular to superior Americanos..	10/9 to 12/9	,,	10/9 to 12/6
Landed.			
Madras Cane Jaggery..	10/-	,,	9/9
Manila Cebu and Ilo Ilo	9/3	,,	9/- to 9/3
Paris Loaves, f.o.b...	17/3	,,	17/3
Russian Crystals, No. 3, c.i.f.	15/-	,,	15/-
Titlers	18/9	,,	18/9
Tate's Cubes..	20/6	,,	20/-
Beet, German and Austrian, 88%, f.o.b. ..	13/-	,,	13/3

THE
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All communications to be addressed and all cheques, &c., made payable to "EDWARD SUTTON, EDITOR OF THE SUGAR CANE, MANCHESTER," which address is sufficient.

For Table of Contents, see page xv.

We publish this month a translation of a very interesting paper on the "Value of Chemical Supervision," contributed to the *Deutsche Zuckerindustrie* by Mr. H. von Zigésar, who is, if we are not mistaken, the chemist in charge of Nonpareil Estate in Demerara.

We are also glad to have details of the experiments made in the same colony with Mr. Donald Skekel's patent cane-mill.

In the absence of fully reliable figures, no sound judgment can be arrived at respecting the real value of one or other process, appliance, or invention, and as proprietors of estates are very chary of having detailed results published, it is satisfactory to be able to give the two accounts above referred to. We believe the extraction now being obtained by crushing in Demerara is considered highly satisfactory, and planters there do not think they have much to learn on that head.

The following figures and facts respecting the Queensland sugar industry are taken from the *Mackay Mercury*:—

"The weather throughout the colony (says the *Mackay Mercury*) has been against a heavy sugar crop this year, and there seems to be little doubt that a deficiency of more than 10,000 tons on last year's output is certain. In fact Bundaberg and Mackay are likely to lose this much between them. The original estimate for this season was 64,525 tons, of which Mackay was to contribute 17,900 tons, and

Bundaberg 20,000. The Herbert River factories were expected to produce 9,300, the Burdekin 4,400, and the Johnstone 7,700, while other districts would give smaller amounts. These figures, it is anticipated, will have to be considerably modified, and it is likely that twenty per cent. will not be too much to deduct. Of the original estimate, the Central Sugar Refining Company bought or were to make 23,600 tons, leaving a balance only of 40,525 tons to go into direct consumption. Of this at least ten per cent. will be low sugars which must go abroad, and deducting this and 20,000 for the colony's own requirements we have a balance for export of 17,000 tons. From present prospects this amount is likely to be still further reduced, as we have said, by twenty per cent. At the two central mills at Mackay it was estimated 2,500 tons of sugar will be made this year, against 1,880 tons last year."

In a report on agricultural machinery in use last year in India, mention is made of Messrs. McOnie's sugar mill with horizontal rollers as being in great demand, and Shank's sugar mill as working with great success in the Bombay district. The sugar imports into Calcutta in 1890-91 were unusually heavy, the increase being in beet sugar from England, Australia, and Germany.

The sale of a Jamaica estate—the Golden Grove—was lately effected in London for a sum of £15,750. It is situated in the parish of St. Thomas, and contains 2,144 acres, only 150 acres being planted with cane, which in 1890 produced 100hhds. of low-grade sugar, and 50 puncheons of rum.

The prospects in Cuba, according to latest advices, point to a large crop, the cane being in splendid condition. Planters are, however, finding a difficulty in raising funds to complete their preparations for grinding, owing to the monetary crisis, and this, with the further tax of 20 cents per bag which is expected to be levied on sugar from the 1st January next, make the outlook as regards possible profits a very serious one. The *Havana Weekly Report* says that the necessity of having able chemists at the head is being felt in many large manufactories, three planters—Messrs. Crespo, P. L. Fernandez, and Duranona's heirs—having already taken this step. Some 1,450 tons of new machinery is being placed in the central factory, "Constancia,"

belonging to Messrs. Apezteguia Bros., the capacity of the existing plant having proved too small last campaign.

An article in the *Revista de Agricultura* estimates that with a yield of 9 per cent. of first and second sugar, in the district of Cienfuegos, the cost of production will average \$17·11 per hogshead, and the price realisable being \$36·67, there is a net profit of \$19·56. This is reduced by sinking fund and cost of repairs and maintenance to \$7·06, equivalent to 5·65 per cent. on value of a large estate.

The remarks, apparently rather premature, which have been made in the *Sucrerie Belge* and some other European papers, respecting the Manoury process which has been tried at the Constancia Central Factory in Cuba this year, have drawn forth very energetic protests from the inventor in the *Sucrerie Indigène* and the *Bulletin de l'Association des Chimistes.* An overseer, writing to the Demerara *Argosy*, seems to be of the opinion that there are some very good points about the system, and that it deserves studying.

The latest advices from Barbados report that the canes present a wonderfully luxuriant appearance. The weather seems to have been equally propitious here as in Cuba.

Reports are current of overtures having been made to Denmark by the United States for the purchase of the island of St. Thomas.

The Mount Edgecombe sugar estate, in Natal, was lately inspected by Sir Henry Brougham Loch and suite, under the guidance of Messrs. Marshall Campbell, G. Sinclair Smith, and others.

Although Mr. Carl Steffen has lost in the law-suit brought against him by Mr. Scheibler, he is said, by virtue of his numerous other patents, to be able to work his system of refining, notwithstanding that judgment has gone against him on one special point.

PROTECTIVE LEGISLATION.

The unsatisfactory character of the system of levying heavy duties on productive industry, and endeavouring to some extent to counterbalance them by more or less heavy bounties, is once more being forcible illustrated in the case of Belgium, where the cultivators of beets are complaining of the existing fiscal legislation, although the general supposition (which is supported by the declaration of the President of the Société des Fabricants de Sucre) is that the beet industry in that country is in a highly flourishing state. The demand of the cultivators is for the tax to be levied on the beets, the system adopted in France in 1884, to which the latter country attributes the present prosperous condition of its sugar industry in general. The Belgian fabricants think just the same of their system of the tax levied on the juice. If protection really were the great boon that its advocates declare it to be, why then should we have these constantly recurring demands for change? The legislation recently adopted in Germany is a clear indication that the financiers of that country are at last, though late, *mieux vant tard que jamais*, fully convinced of the innate rottenness of protection supplemented by bounties on special articles.

Turning to the great American republic, one cannot repress a feeling of astonishment that a nation which claims, with some justice, to be in the van of civilisation, and from its high standard of general education and intelligence should be in a position to profit by the errors and dearly-bought experience of the Old World, could ever be brought to think that the exaggerated system of protection put in force under the McKinley Act—however apparently cleverly devised to favour its immediate interests—can in the long run really conduce to a state of sound commercial and social well-being. However, the facts are there, for future ages to wonder at, even if, as is not impossible, they should be very materially modified by the not unlikely success of the Democratic party in 1892.

The position, however economically unsound, is for the moment no matter for mere wonder or speculation to the West Indian Colonies, who have been wisely bringing all possible pressure to bear on the home Government, for the time is rapidly approaching when the provisions of the McKinley Act will be put in force, and the President will have the power to exclude the sugars, &c., of all countries who, in his judgment, do not treat the American Republic fairly by

admitting its produce on adequately favourable terms. The appointment of Mr. Nevile Lubbock and Mr. Ohlson to advise with Sir Julian Pauncefote in the negotiations now proceeding will commend itself heartily to all who know the peculiar fitness of these gentlemen, especially the first named, to represent West Indian interests, and it is heartily to be desired that no prejudices or obstinate adherence to precedence or antiquated ideas may stand in the way of our Government's taking a thoroughly statesman-like view of the matter. It would be absurd and unworthy of an intelligent people to expect that the West Indian Colonies either can or will overlook their own plain interests in this matter; they are undoubtedly deeply, and perhaps enthusiastically, attached to the mother country, but necessity knows no law, and they have some cause to complain of former inconsiderate treatment in a similar, though not nearly so imperatively urgent matter as the present.

THE FOREIGN TRADE OF THE UNITED STATES.

	1890-91. £	1889-90. £	Increase or Decrease in 1890-91. Per cent.
Imports, free	73,247,000	53,133,000	+ 37·7
,, dutiable ..	95,734,000	104,728,000	— 8·6
Total Imports.. ..	168,981,000	157,861,000	+ 6·6
Exports, domestic..	174,454,000	169,058,000	+ 3·2
,, foreign ..	2,440,000	2,507,000	— 2·7
Total Exports.. ..	176,894,000	171,565,000	+ 3·1
Total Trade	345,875,000	329,425,000	+ 4·9

The above table (made up to June 30th) shows the movements of the foreign trade in the United States for the past twelve months, as compared with those of the previous year. The attention is at once excited by the large increase in the free imports amounting to nearly 38 per cent. It is fair to conclude that a large portion of this is due to the increased import of sugar during the nine months April, 1890, to June, 1891. In estimating the decrease of dutiable imports, we must not forget that about £3,000,000 worth of tin-plates was bought in anticipation of the large increase of duty which came into force on July 1st of the present year.

DEMERARA.

Report on Experiment with Skekel's Mill.

At the last meeting of the Royal Agricultural and Commercial Society, it was understood that a Report on the result of an Experiment with Mr. Donald Skekel's Patent Mill was to be printed in readiness for the next meeting. The following is the text of the Report as given by the *Demerara Chronicle*, and we reproduce it in full because of the great interest attaching to all details of mill work, joined to the difficulty of obtaining reliable reports:—

To the Royal Agricultural and Commercial Society.

During the year 1889, Mr. D. Skekel brought to the notice of the Society a new cane mill which he had patented, and showed a model of his machine before the Society. The advantages claimed for this new form of cane mill were prevention of the reabsorption of the juice by the megass when passing out of the last pair of rolls, the doing away with the Trash turner and the friction caused thereby, a small grooved roll travelling at a quick speed taking the place of the ordinary Trash turner and the lower horse power required to drive such a mill.

The new mill of Mr. Skekel excited considerable attention both amongst engineers and sugar planters, but either from want of pluck or want of means no one took up the patent to give it a trial until Mr. W. Smith, of Plantation Herstelling, came to the front, and he ordered, through Mr. Skekel, a new pair of beadstocks designed for Skekel's mill, utilising the old rolls on the estate to complete it. I may say here that these rolls were considerably worn and of different diameters. The mill was erected at the beginning of the year to take off the present crop, and when started was visited by a great many engineers and planters, and gave a favourable impression as to its capabilities as a cane-crushing machine; but beyond some trifling experiments which could hardly be considered satisfactory no actual figures as to the results obtained could be given, and it was, in my opinion, necessary that actual data should be furnished by the patentee if others were to take up the machine. I may say there were no appliances on the estate for conducting these experiments. After the lapse of some time I obtained permission from the patentee and Mr. Smith to make a test of the machine, and asked Mr. Cornish as engineer and Professor Harrison to assist me in conducting the experiment. Unfortunately on the day fixed Professor Harrison was too unwell to attend, and Mr. Douglas, the chemist, of Plantation Diamond, filled his place.

On Thursday, 20th August, twelve tons of canes having been weighed on the previous day by a clerk from my office, and the weight verified by

one of the employees of the estate, on a large platform scale kindly lent for the occasion by the Government through Mr. Darnell Davis, a careful test of the mill was made in presence of Mr. Finney, the engineer of the estate, and Mr. Skekel as patentee and representing Mr. Smith, Mr. Cornish taking the results of the working of the engine, Mr. Douglas watching and measuring the juice, the weighing of megass being assigned to Mr. R. W. H. Jones, late of the Sydney Sugar Refining Works in Australia, and Mr. Skekel, the cane carrier, being superintended by myself. Everything was carefully done, Mr. Douglas taking numerous samples of the juice and canes for analysis, and all expressed themselves as satisfied with the manner in which the experiment was conducted, and that it was a fair test of the mill's power.

The difference in the size of the roll was, I think, against the mill, as although the megass was finely broken, the results show it created a false impression, judging by the eye, I think most of those who saw the experiment anticipated a much higher percentage of crushing, and this demonstrates what I have always held to be the case, that it is almost impossible to judge the work of a mill without actual analysis. I am under the impression myself, and I think others agree with me, that had the rolls been all of equal size better results would have been obtained, but we had to take the mill as we found it, the patentee running this amount of risk.

The canes experimented on were free from all trash, and of good average quality.

The following are the reports of the Chemist and Engineer:—

Diamond, 22nd August, 1891.

The Hon. B. Howell Jones,
Georgetown,

Dear Sir,—Herewith I send you a report of last Thursday's mill trial at "Herstelling."

The result, though good single crushing, is somewhat disappointing, coming after the glowing accounts of this mill which have been going the round of the Colony recently. The appearance of the megass on the elevator certainly led me to expect a better result; an explanation of the finely divided condition of the megass has just occurred to me; the rolls of the mill from frequent turning up are all of different diameters, the thickest being, I understand, as much as 2 inches greater in diameter than the thinnest, the rubbing action of the roll surfaces on the megass, owing to different circumferential speeds of rolls, is quite sufficient, I think, to account for the fine division of megass.

The result of the trial is, I think, fairly reliable within the limit stated, that is $\frac{1}{2}\%$ above or below.

I am, yours very truly,

WILLIAM DOUGLAS.

REPORT OF THE TRIAL OF SHEKEL'S PATENT CANE MILL, AT PLN. "HERSTELLING."

20th August, 1891.

Weight of Canes (weighing on previous day)............ 12 tons.
Weight of Megass.................................. 8,758 lbs.
Weight of Juice...................................17,018 lbs.

being 1,590·2 gallons juice, measured at 30°C.
Specific gravity at same temperature being—1·0702.

The crushing can be calculated from three sets of data, and errors will be best eliminated by taking the average of the three results as the correct one.

I. Crushing calculated from weights of canes and megass—both weights being uncorrected—

Weight of Canes.................................. 26,880 lbs.
Weight of Megass .... 8,758 lbs.

then $\frac{8,758 \times 100}{26,880} = 32^{\cdot 58}\%$ megass, and $100 - 32^{\cdot 58} = 67^{\cdot 42}\%$ crushing.

This result is certainly too high, because there was an unavoidable mechanical loss in handling megass from mill to weighing machine, as well as loss of weight from evaporation—corrections for these losses are difficult to apply.

II. Crushing calculated from weights of juice and megass—

Weight of Juice .... 17,018 lbs.
Weight of Megass .... 8,758 lbs.
Weight of Canes................................... 25,776 lbs.

then $\frac{17,018 \times 100}{25,776} = 66^{\cdot 02}\%$ crushing.

III. Crushing calculated from weights of canes and juice. Weight of canes being corrected for loss during period between weighing and actual crushing—1 day = Correction—2% deducted from weight—

Weight of Canes, 26.880 lbs.—2% = ... 26,342 lbs.
Weight of Juice.................................. 17,018 lbs.

then $\frac{17,018 \times 100}{26,342} = 64^{\cdot 61}\%$ crushing.

Mean of three results—

$$\frac{64{\cdot}61 + 66{\cdot}02 + 67{\cdot}42}{3} = \underline{\underline{66^{\cdot 02}\% \text{ crushing.}}}$$

The probable error of this result is $\pm 0^{\cdot 54}$

I take 66·02 % as the correct crushing, and will use the data of computation II. (which yields same result) in the further calculation of sugar extraction and loss.

Cane.	Juice.	Megass.
25,776 lbs.	17,018 lbs.	8,758 lbs.

Analyses.

Cane. (actual determination.)	Juice. (actual determination.)		Megass. (calculated.)
		lbs. per gall. = % by wt.	
Fibre 11·30%			Fibre —
Saccharose 13·00%	Saccharose	1·644 = 15·36	Saccharose 8·41%
	Total Solid Matter	1·916 = 17·90	
Juice 88·70%	Spec. Grav. at 30° C.	(17·5 S 30)—1·0702	
	Quotient of Purity	85·8	

Factor specially (determined for this lot of cane) to convert Saccharose % in juice to Saccharose % in cane—0·8457.

The juice was sampled continuously at mill bed and at clarifiers during the course of the experiment. Juice heater was not working.

The mean of the two following analyses is taken as the average composition of the juice:—

Cane Juice. *Sample from Mill Bed.*

	lbs. per gall.		% by wt.
Saccharose	$1^{\cdot 635}$	=	$15^{\cdot 28}$
Total solid matter	$1^{\cdot 916}$	=	$17^{\cdot 90}$
Special gravity at 30°C.....................	($17^{\cdot 5}$ s30)		1·0702
Quotient of purity	$85^{\cdot 33}$		

Sample from Clarifiers.

	lbs. per gall.		% by wt.
Saccharose	$1^{\cdot 653}$	=	$15^{\cdot 45}$
Total solid matter	$1^{\cdot 916}$	=	$17^{\cdot 90}$
Specific gravity at 30°C	($17^{\cdot 5}$ s30)		1·0702
Quotient of purity	$86^{\cdot 27}$		

then total sugar in the canes—

$$\frac{25776 + 13}{100} = 3351 \text{ lbs.}$$

Sugar in juice—

$1590^{\cdot 2}$ galls. @ $1^{\cdot 644}$ lbs. per gall. = 2614 lbs.

and $\frac{2614 \times 100}{3351} = \underline{\underline{78^{\cdot 01}}}\%$ of sugar in cane extracted in Juice.

	% of Cane.		
Saccharose in cane..........................	13·00	—	100·00
Saccharose in juice extracted	10·14	—	78·01
Saccharose lost in megass	2·80	—	21·99

William Douglas, F.I.C., F.C.S.

Diamond, 22nd August, 1891.

3rd September, 1891.

Pln. Herstelling—Memo. of Indicated Horse Power of Engine driving Cane Mill, during trial run, on 20th August, 1891.

Diam. of Steam Cylinder 22 inches
Stroke, 42 ,,
Diar. Piston rod, $3\frac{11}{16}$,,

Engine makes 13 revolutions for one revolution of Mill. Engine works mill, Cane Carrier, Elevator, Liquor pump, and Cold Water pump (latter about $3\frac{1}{2}$ inches diam., 21 inches stroke.)

Mill—Top roller 26 inches diam., 54 inches face.
,, Back ,, $25\frac{1}{2}$ inches $25\frac{1}{4}$ inches diar.
,, Front ,, $25\frac{1}{2}$ inches $24\frac{1}{2}$ inches ,,

It is fitted with Skekel's Patent Head Stocks and Rotary Turner.

A pressure gauge was fixed on the steam main, close to the Engine cylinder, and the pressures shown are given in the accompanying table.

It must be noted that no diagrams were taken from the bottom of the Cylinder; too much condensed water was present to render them of much use. Also that the hole for Indicator Cock was drilled into hollow cylinder cover. This was not discovered until the experiment was about to commence, and then a piece of pipe was screwed into cover, to prevent steam from filling the cover at each stroke. This was done as carefully as circumstances allowed, but one could not be sure that no steam got into the cover at each stroke, because the inner end of the tube was carefully fitted, but could not be screwed at lower end.

No. of Card.	Pressure at Gauge.	Planimeter Reading.		Average Effective Pressure.		Revolutions per Minute.	High Pressure by Card.
		Maximum.	Minimum.	Maximum.	Minimum.		
	lbs.			lbs.	lbs.		
1	50	576	567	34·56	34·02	24	75·4
2	50	589	582	35·34	34·92	32	89·3
3	50	575	288	34·50	17·28	30	61·7
4	50	545	508	32·70	30·48	36	90·4
5	54	599	599	35·94	35·94	40	114·6
7	54	423	288	25·38	17·28	33	55·9
8	54	411	321	24·66	23·46	36	68·8
9	54	367	240	22·02	14·40	36	52·1
10	50	426	426	25·56	25·56	34	69·1
11	55	286	246	17·16	14·76	36	45·6
12	50	437	399	26·22	23·94	36	71·7
		5,234	4,534	314·04	272·04	373	794·0
				272·04			
				586·08			
				2 × 11	26·6lbs. mean pressure.		

Each card shows 5 to 8 diagrams—*i.e.*, the indicator pencil was allowed to mark during 5 to 8 consecutive revolutions of engine; the extremes of these are taken as "maximum and minimum" in the above.

Then $\frac{5,234}{11}=47\cdot582\times0\cdot6=28\cdot54$ lbs. maximum average of cards.

$\frac{4,534}{11}=4122\times0\cdot6=24\cdot73$ lbs. minimum ,, ,,

$\frac{53\cdot27}{2}=26\cdot6$ lbs. mean effective p. of the cards.

Area of cylinder 22in. $=380\cdot133$

$\frac{1}{2}$ piston rod.... $3\frac{11}{16}$ $=5\cdot34$

$374\cdot793$ = effective area of cylinder.

And $\frac{373}{11}=33\cdot9$ mean revolutions per minute.

$\frac{374\cdot793 \text{ sq. in.}\times26\cdot6 \text{ lbs.}\times33\cdot9 \text{ r.}\times7\text{ft.}}{33,000}=\underline{77\cdot7}$ I.H.P. mean average.

Trial began at 12h. 55m.; ended at 2h. 13m.....................=78 m.
Stoppages for megass to be disposed of for purposes of weighing=13 ,,

Leaving actual time occupied in crushing the 12 tons of canes...... 65 ,,
Quantity of juice, as per Mr. Douglas' report, 1590·2 galls.

Gallons per hour $\frac{1,590\times60}{65}=\underline{1,468}$ galls. per hour.

And $\frac{71\cdot7}{14\cdot68}=\underline{4\cdot88}$ I.H.P. per 100 gallons expressed per hour.

Friction diagram, taken when cane carrier (nearly full of canes) and elevator (empty) were working; no canes between the rollers—gave

$$\begin{array}{r}4\cdot4\\7\cdot6\\\hline\end{array}$$

$\frac{12\cdot0}{2}=6\cdot0\times0\cdot6=3\cdot6$ lbs. mean effective pressure.

And $\frac{374\cdot79\times3\cdot6\times7}{33\cdot000}=0\cdot28$ I.H.P. per revolution.

Taking mean revolutions per minute as before—or 33·9—gives for friction $33\cdot9\times0\cdot28=\underline{9\cdot49}$ I.H.P.

During the above trial, no use was made of the exhausted steam which escaped through loaded valve; cards show the back pressure to be about 10lbs. per square inch.

The results of trial, are as below; measurement of juice; % crushing and Fibre in cane having been determined by Mr. Douglas:—

Weight of canes crushed	26,880 lbs.
Time occupied in crushing	65 minutes
Crushing—as given by Mr. Douglas	66·02 %

Fibre in canes—as given by Mr. Douglas..	11·30 %
Mean indicated Horse power of Engine	71·7 I.H.P.
Mean indicated Horse power per 100 galls. per hour ..	4·88
Friction card—under above named conditions	9·49 I.H.P.

T. S. Cornish.

Letter from Mr. Skekel.

Georgetown,

September 2nd, 1891.

Hon. B. H. Jones.

My Dear Sir,—I have received Mr. Douglas's report on the working of the Herstelling sugar cane mill, for which I thank you.

From the dry and pulverised appearance of the megass and the uniform squeezing of the mill, I, like Mr. Douglas, anticipated a higher extraction of cane juice. I fully expected 70 per cent. on the weight of canes passed through the mill would have been the final result of extraction.

"Comparisons are said to be odious," but I cannot refrain from referring to one, and when looked into it shows the mill at Herstelling has not come out of the trial badly.

I am informed by Mr. Aitchison, the engineer of Pln. Vreyheid's Lust, that the 5 roller mill on that estate gives an average extraction of 68 per cent. of the weight of canes passed through the mill. Taking Mr. Douglas's first formula on this head, the Herstelling mill is allowed to have extracted 67·42 per cent., or within ½ per cent. nearly of the 5 roller mill at Vryheid's Lust.

The ratio of gearing attached to the Vryheid Lust mill is 25 to 1, while the Herstelling mill is 13 to 1, the former nearly 100 per cent. more powerful than the latter. The rollers at Herstelling cane mill, owing to repeated turnings of their surfaces, are according to the following dimensions :—Top roller—a new one, 26 inches diameter. Lower part roller—25¼ inches diameter, and final crushing rolls—24½ inches diameter.

Had all the rollers the same diameters, and their surfaces running at the same circumferential speed, better results might have been obtained. I am unable, from practical experience, to give an opinion on any of the others.

In ordinary mills, where first cost is no consideration, I would advise an entire new mill in preference to altering the old one, and I consider better results would follow.

I shall be glad to have Mr. Cornish's report.

Yours respectfully,

Donald Skekel.

SUGAR IN INDIA.

Under the above heading we gave, in our September issue of this year, some extracts from a memorandum on the cultivation and manufacture of sugar in India by Messrs. Thompson and Mylne, of Beheea, Bengal, suggested by the remarks of Messrs. Travers and Sons (see *Sugar Cane*, June, 1890). We now print a further extracts from the same memorandum, giving details of the great advantages arising from the improved machinery introduced by Messrs. Manlove, Alliott, Fryer & Co. (see *Sugar Cane*, September, 1891, page 477). The statement of figures adduced shows clearly what can be done, even under the present unfortunate system, with machinery properly adapted to the special wants of the small Indian cultivators. We can, however, regard the great advance thus gained as a preliminary to a much larger eventual production of sugar in India, which we look upon, in spite of initial difficulties of no ordinary magnitude, as simply a question of time. The sugar consumption of the world has scarcely attained to a tithe of its possible ultimate dimensions, and the time is not far distant when the rulers and people of India will find that a yet unworked mine of wealth is lying at their feet, only waiting for administrative ability and judicious outlay of capital to realise such a change in Indian sugar production as is hardly yet dreamed of.

"The advantages of this process were found to be so real, the gain so substantial, that a demand arose for the small spinners which increased to a rush, and as with too rapid multiplication of cotton mills, jute mills, tea gardens, &c., so with these spinners, an excessive number were started within a few months, sufficient time not being given for the new and special products to become known over an area wide enough to admit of the whole quantity produced being sold at paying rates, and there was for a time the usual disappointment, but the demand has overtaken production again, and there is every indication of another "boom."

"It was felt that, having regard to the conditions which prevail in India, it was best to begin with the cultivators, and the results obtained so far appeared to justify this.

"The following particulars from the traffic returns of the East Indian Railway show a large increase in the exports from the Shahabad Railway stations of sugar (grain sugar and *gur*) from 1874, the year in which these improvements began to operate :—

	Maunds, Sugar and *gur* exported.	Behcea Mills working in District.
1874..	28,170	*
1875..	56,900	226
1876..	51,500	714
1877..	307,200	1,639
1878..	486,000	2,813
1879..	461,400	5,358
1880..	638,000	6,800
1881..	606,200	8,000
1882..	817,000	9,286
1883..	496,100	10,000
1884..	236,000	10,200†
1885..	431,500	10,300
1886..	621,400	

"These figures are an indication only of what the total increase has been, as there are exports south, north, and in other directions by carts, pack bullocks, boats, &c., and a substanial increase in the local consumption.

"Sone Canal water for irrigation being made available about the same time, helped to make the increase greater than it could otherwise have been, but, as before stated, there could have been no such extension had the cultivators not felt that the new mills would enable them to crush the cane within the time available.

"Sir Edward Buck (now Secretary of the Government of India in the Department of Revenue and Agriculture), when Director of Agriculture in the North-West Provinces and Oudh, became aware of the extent to which the cane growers of Behar were taking to these new machines, and in 1877 obtained Government sanction to the procuring of a number which were sent to different districts of his province. As in Behar and Lower Bengal, so further west, it took time to convince the cultivators, but after several seasons of doubt, hesitation, and suspicion, numbers of cane growers began to inquire for the new mills, and a rush for them followed. Depôts for supplying them were opened in various North-Western Provinces districts, and in June, 1888, Mr. J. B. Fuller, then Assistant Director of Agriculture, North-Western Provinces (now Commissioner of

* A small number of experimental mills. † Short cane crop.

Agriculture and Settlements, Central Provinces), wrote regarding results obtained with the new machines as compared with the *kolhu*. "If we may apply the result of this experiment to the total pro-"duction of sugar in these provinces, it follows that by the substitu-"tion of the Beheea mills for the *kolhu* now used, the total annual "produce would be increased by the value of nearly a crore and a "quarter of rupees," *i.e.*, a million and a quarter sterling. The benefit has been increasing year by year in the North-Western Provinces as in other parts of India. In the Punjab also depôts were opened, and a district committee of leading cultivators reported to the Director of Agriculture (Colonel Wace), after trials made in 1883, that the money gain per season, by using even the smallest size Beheea mill instead of the "*belua*," was about Rs. 360, and that it gave "other important advantages." Similar results were obtained in the Central Provinces, Madras, Lower Bengal, and other parts of India, and if only a third of Rs. 360 per season be taken as an average, to allow fully for mills which work only part of the season, as also for other deductions, the gain on the total number of mills in the hands of the cane growers in each season from 1874 will be:—

							Rs.
1874—74	from	800	mills,	at Rs. 120	per mill	..	96,000
1875—75	,,	1,500	,,	,,	,,	..	1,80,000
1876—76	,,	2,300	,,	,,	,,	..	2,76,000
1877—78	,,	5,700	,,	,,	,,	..	6,84,000
1878—79	,,	9,000	,,	,,	,,	..	10,80,000
1879—80	,,	12,000	,,	,,	,,	..	14,40,000
1880—81	,,	17,000	,,	,,	,,	..	20,40,000
1881—82	,,	25,000	,,	,,	,,	..	30,00,000
1882—83	,,	30,000	,,	,,	,,	..	36,00,000
1883—84	,,	40,000	,,	,,	,,	..	48,00,000
1884—85	,,	55,000	,,	,,	,,	..	66,00,000
1885—86	,,	70,000	,,	,,	,,	..	84,00,000
1886—87	,,	80,000	,,	,,	,,	..	96,00,000
1887—88	,,	100,000	,,	,,	,,	..	1,20,000,000
1888—89	,,	150,000	,,	,,	,,	..	1,80,000,000
1889—90	,,	200,000	,,	,,	,,	..	2,40,000,000
1890—91	,,	250,000	,,	,,	,,	..	3,00,000,000
		Total		..	..	..	12,57,96,000

"These figures are based on the experience of cane growers in various parts of India, and on reports made by officers of Government, Engineers, and others who have taken pains to make sure of the reckoning, and they indicate a small part only of the loss sustained by cultivators in India through defective appliances and crude methods. It is to be noted that these figures show what was being lost by *some only* of those who grow sugar cane in India, and that they represent only that part of the total which has been already recovered. What the total loss is in connection with this one crop can only be realized by those who have some knowledge of the careful treatment which is requisite to secure a full percentage of the sugar which cane or beet can yield, and who have also had opportunity of observing the crude wasteful appliances and methods which are used by Indian cane growers. It is also to be noted that similar losses are being sustained in connection with other crops such as oil-seeds, wheat, barley, maize, fibres, and dye-stuffs."

Specimens of unrefined and half-refined sugar were sent to the Secretary of State for India by Messrs. Thompson and Mylne, and by him referred to Messrs. Travers and Sons, who reported on their value and saleability in August last.

INDIA.

Cane Growing from Seeds.

There is one matter referred to in the last Annual Report of the Botanical Gardens at Mussoori and Saharunpore, which is of more than local interest, and that is the account of the experiments that were made at the Gardens at the latter place to grow sugar cane from seeds. Little success attended the experiment; but this was not the fault of the Superintendent of the Gardens, but to the difficulty that he met with in obtaining seeds; in fact, only two samples of seed were obtained in India and one from Perak. Mr. Holderness, the Director of Land Records and Agriculture in the North-West Provinces and Oudh, says that the Superintendent has, so far, met with success, in that he had obtained seed and had grown seedlings from it; but the experiment may have to extend over a series of years before new or improved varieties of cane appear. In the West Indies the method of propagating the cane from seed has attracted much attention, and its importance is recognised alike by the

scientific world and all persons interested in the sugar industry. The chief cause of the difficulty in obtaining sugar cane seed in India is to be found in the superstition of the natives. The Superintendent of the above Gardens has, in the course of his enquiries, elicited the following interesting facts. As soon as the three lots of sugar cane seed were obtained they were sown in pots and kept under glass. In a short time the pots were filled with seedlings of grasses, several of which were identified as seedlings of the sugar cane by the husks of cane seed attached to the seed leaves. In several pots, however, the seedlings were identified as weeds belonging to the other species of grasses. The seeds received from Perak entirely failed to germinate. Referring to the difficulty of obtaining the seeds the Superintendent says that the sugar cane rarely flowers, and, not being a very conspicuous flower, it is easily overlooked. The native growers are not to be counted upon to obtain seed owing to their superstitious belief in the ill omen of the sight of the flower. In Oodeypore this superstition is said to be general, and should a cultivator happen to see a cane in flower he gives the whole field in which the cane is growing to the Brahmins. In Bijnor, it is reported that whole fields are sometimes burned down should a flowering cane be seen in them. These reports have to be taken with reserve, for an intelligent Zemindar living in a tract of country where the cane is largely cultivated, while admitting the prevalence of the superstition, said he had never heard of a field being given away or burned simply on account of a cane being seen in flower. However, the superstitions may vary in different districts, and so long as the belief in the evil omen exists, so long will the difficulty of obtaining seed be experienced.—*Indian Agriculturist.*

CONSULAR REPORT.

SPAIN.

The cultivation of beet root continues to have a certain success in the neighbourhood of Malaga, and factories are at work near Granada, Antequero, and San Pedro de Alcantara, &c. In the year 1890, according to official statistics, 155,700 tons of beets were worked up, the mean product of refined sugar being $7\frac{1}{2}$ per cent. of the weight of roots; the cost of manufacturing being about 15 pesetas* a ton, there was a profit of 13 pesetas per 1,000 kilos. (very nearly a ton).

* The peseta is equal to about $9\frac{1}{2}$d.

CUBA.

DECEPTIVE YIELDS.

(Rendimientos Ilusorios.)

Under this title the *Revista de Agricultura* has the following highly suggestive article:—

"Since the close of this last season we have remarked in certain Cienfuegos periodicals a propensity to ascribe to certain estates yields which are fanciful and completely illusory. This is done without adducing any of the data of the manufacture, which might serve as a proof of the assertions. Now, what is the object of those who give publicity to the statements respecting these exaggerated yields? Whom do they expect to take in? Other planters? They cannot think so; for the latter generally know what takes place on their neighbours' estates as well as the owners themselves. Is it business men in general? That would be a difficult task, for they are accustomed to scrutinize closely statements which depict things in such brilliant colours, and to make their own calculations accordingly, and as they see that, far from there being any improvement in credit, people are asking for an extension of terms, they know at once what to think of matters. Do they want to deceive the Government, to make them believe that they must not compromise the future by pressing harder on the sugar industry than they do at present? Scarcely; for the Government will take into account the fact that the statements refer to only one estate out of the whole number in the island, and consequently that such figures cannot be taken seriously, or serve as a basis for anything, least of all for establishing the rate of taxation. More than this, there would certainly be some deputy who would put things in a clear light in the Cortes.

"This anxiety to individualise questions which, from their very nature, can only be settled collectively, in connection with well-established figures, brings no benefit whatever to the sugar producers of Cienfuegos; on the other hand, it has had the pernicious effect of still further increasing the profound discontent and the bad state of things that prevails amongst the sugar cultivators in that district, more especially those which belong to the estates to which the miraculous results are attributed.

"When a cane cultivator reads, for example, that at the Constancia Central Factory, as is asserted by the *Imparcial* of Cienfuegos, 500 arrobas of cane have sufficed for the production of 62½ arrobas of

sugar, which means that a yield of $12\frac{1}{2}$ per cent. has been obtained, he begins to have his doubts.

"He knows very well the manner in which the crushing is done at this factory, the mills of which can be seen, and he is perfectly able to establish the relation between the dimensions of their rollers, the revolutions per minute, and the enormous quantity they have to grind per hour, and he arrives at the irrefutable conclusion that in this case the yield of the mill, that is, the extraction of the juice, is perforce sacrificed to the output, and that the extraction does not exceed 66 per cent.

"As on the other hand the planter also knows that the saccharine richness of the cane in those districts, even when the latter is perfectly ripe, does not, on the average, exceed 17 per cent., he easily arrives at the following proportion :—

$$\frac{17 \times 66}{100} = 11{\cdot}22$$

Deducting from this 11·22 of sucrose which passes to the defecators, the 0·50 per cent. minimum loss by evaporation, plus 0·15 loss in the scum cakes, together 0·66, he gets 10·57 as the amount of sugar remaining in work. Further, as the planter knows that this very juice contains 0·60 per cent. of glucose and 0·20 of ash, he deducts from the 10·57 the quantity of uncrystallizable sugar resulting from these two factors, viz., $0{\cdot}60 + (0{\cdot}20 \times 4) = 1{\cdot}40$ and $\frac{1{\cdot}40 \times 66}{100} = 0{\cdot}92$,— thus leaving 9·65. But at the same time he is not ignorant of the fact that a portion of this 9·65 of crystallizable sugar remained in the 9,000 hhds. of molasses which were produced at Constancia this year, in spite of its special process for suppressing the molasses, and deducting on this head nearly 0·40, he will obtain as the possible yield 9·25 in sugar of all jets, or in sugar of one single jet, the molasses being used over again, a yield which probably corresponds with what would be shown by the factory memoranda of these works, if they were consulted.

"But as pains are being taken to proclaim *urbi et orbe* that the Constancia Central Factory at Cienfuegos, notwithstanding its having produced 9,000 hhds. of molasses, has obtained a yield of 12·50 per cent. of sugar in the cask, the planter looks for this 12·50 minus $9{\cdot}25 = 3{\cdot}25$ overplus, for which there is no explanation, and has recourse to the following proportion :—

$$\frac{100 \times 12{\cdot}5}{9{\cdot}25} = 136{\cdot}20$$

which indicates that in reality 136·2 arrobas of cane have been required for these 12·50 arrobas of sugar, or in other words that there was an error of 36% in the balance, always supposing that the 12·50% yield was a fact, and hence comes the tendency of the cultivator to believe, without being sure of it, that he is being made a victim.

"Instead of in this manner contributing to sow doubt and distrust among the agriculturists, would it not be better and more reasonable to tell the truth plainly and fully, and prove it by technical data?

"To say that you have got a yield of 9·25% with 66% mill extraction, and 9000 hhds. of molasses, is this stating a result which can in any way be incorrect, or could in the least hurt the *amour propre* of the owner of a central factory? And can a net profit of $3·25 on each hhd. of sugar, (above all with such an enormous quantity of molasses), or a net gain in all of $100,000 in one season, be regarded as one of which any proprietor of estates can be ashamed? We believe not."

THE VALUE OF CHEMICAL SUPERVISION IN CANE SUGAR FACTORIES.

By H. von Zigesar.

(Translated from the *Deutsche Zuckerindustrie.*)

Proprietors of cane plantations have to depend for their net profits, whether from cultivation or manufacture, entirely on the quantity of sugar and molasses which they obtain from the factory.

The most expert planter can, therefore, only find a return for the trouble and labour expended in the production of heavy crops of cane, containing a large quantity of sugar, in a high percentage of yield obtained in the factory, combined with a minimum of loss in juice and sugar, the ascertainable and unascertainable losses being kept within bounds conditioned by the process of manufacture.

The possible losses during manufacture are very manifold, and consist of *mechanical* and *chemical* losses. Both these kinds of losses commence *in the field*, from the time the cane is cut, and continue more or less throughout the whole process of manufacture until the sugar is weighed and sacked, and the molasses measured, or (preferably) also weighed and put into barrels.

Mechanical Losses are the following:—Cut cane overlooked and left lying in the field; cane which in loading or on the road to the factory, or on being unloaded, falls into the water; and, finally, that which is lost by theft of the field-hands, who are more or less accustomed to consider cane as an article of food which they ought to get for nothing. It is not until the cane reaches the factory that the losses commence which can be properly ascertained, especially in those factories where the cane is weighed on receipt.

Chemical losses also commence immediately after the cane is cut, owing to the vegetable acids, which are constantly present in the cane, affecting the cane sugar ($C_{12} H_{22} O_{11}$) in the direction of converting it into the $C_6 H_{12} O_6$ sugar group.

The actual ascertaining of the chemical losses also commences only in the factory yard, or, rather, when the cane begins to be worked up. Every day's delay in getting the cane into work brings considerable losses of sugar, which make themselves felt in juice of poor saccharine content and with an inferior quotient of purity.

The ascertaining of the losses in manufacture begins with the mill or the cane-cutter; samples of the cane are taken regularly, and the juice is tested for the saccharine content, for those sugars which reduce Fehling's solution, and for the quotient of purity. At the same time, tests are made frequently, or as often as necessary, to determine the fibre, so as to learn the quantity of juice in the cane; experience shows this to amount on the average to 88 per cent. of the weight of cane, leaving 12 per cent. of fibre. For example, if the sugar in the juice is 14·78, then the saccharine content of the cane is 13·00.

This figure forms the basis for calculating the quantity of sugar which passes into work, for as every 100 tons of cane contain 13 tons of sugar, or if we take 13 as = 100 per cent, then in that case 100 tons of sugar passing into work represent 769·3 tons of cane.

If the saccharine richness of the cane is greater, then 100 tons of sugar passing into work do not represent so much cane as in the case of poor cane. Thus, if the

	Tons of Sugar.		Tons of Cane.
Sugar in the cane is 13 per cent., then	100	represent	769·3
,, ,, ,, 16 ,, ,,	100	represent	625

The formula for judging of the work done in the factory is, in its simplest form, as follows: For convenience of reference we will call this

Formula A.

Sugar introduced in the cane....................	13·00	=	100·00
Sugar obtained in the form of masse-cuite........	9·12	=	70·18
Total loss as far as the masse-cuite	3·88	=	29·82
Sugar obtained in first jet	6·81	=	52·38
,, ,, in second jet	1·11	=	8·57
,, ,, in molasses	1·13	=	8·73
Further loss between masse-cuite and molasses ..	0·07	=	0·50

The question of the quality of the cane, which can only be decided by adequate cultivation, is thus left to the planter, and, on the other hand, the planter can at once know whether he has to expect a large or small production per acre. He can determine how his own factory stands in comparison with any other factory as regards efficiency, which he certainly cannot do by being told, "I have got 1·8 or 2·3 tons of first sugar" per acre. From such a statement he can only *suppose* that the former factory had been supplied with cane of poor saccharine content, but he cannot be certain of this. I say expressly "only suppose," because, if the first factory worked with the mill, and the second with diffusion, the quality of the cane may have been the same in both cases. Whether, therefore, the person making the statement conceals or is ignorant of the fact as to which mode of extraction one or the other factory uses, his statements as regards the yield in first sugar are quite valueless.

The extraction of the juice from the sugar cane is effected either by

Single crushing,
Double crushing,
Double crushing with maceration,
or Diffusion,

and these various processes of extraction give the following average results :—

	From 100 tons Cane.	From 100 tons Juice in the Cane.	From 13 tons of Sugar in 100 tons Cane.	Loss in Megass of 13 tons Sugar.	Per 100 ton of Sugar passing into the factory.
	Tons of Juice.	Tons of Juice.	Tons of Sugar obtained in the Juice.	Tons of Sugar lost.	Tons of Sugar lost.
Single crushing......	62	70·4	9·16	3·84	29·6
Double ,, ...	68	77·3	10·04	2·96	22·7
Double crushing with maceration	72	81·8	10·63	2·37	18·2
Diffusion	86	97·7	12·73	0·30	2·3*

* Megass and waste-water.

In the two last processes the juice is obtained by means of a certain amount of dilution, amounting, as compared with the original cane juice, to from 10 to 30 per cent.; further, the megass obtained is wetter than that resulting from single or double crushing. The greater expenditure on fuel caused by this is not only more than counterbalanced by the considerably greater amount of juice obtained, but may also be avoided by suitable evaporating apparatus and arrangements for stoking.

The above results expressed in gallons are as follows :—

	Obtained from 100 tons Cane. Gallons of Juice.
By Single crushing	12,907 (sp. gr. 1,076 = 10·3°B.)
,, Double ,, ...	14,156
,, ,, ,, with maceration....	14,988 or, with 20 % dilution, 17,985
,, Diffusion	17,903 ,, 12 % ,, 20,051

The causes of loss between the extraction apparatus and the final masse-cuite vary according to the different modes of treating the juice. As a general rule, the mechanical losses of the juice are greater in proportion to the greater number of pipes and vessels which the juice has to traverse before leaving the vacuum pan in the shape of masse-cuite, because the danger of manifold defective connections and leakages is thereby increased. Mechanical losses further take place in the sawdust-like fibre (called *cush-cush*) which is caught by the hair-sieve; in the scum of the filter-press; in the waste-water of diffusion; and in the bone-black or the sand of the Baur filter-presses. I shall classify losses through leakage and defective connection of the pipes under the name of *unascertainable losses;* they are found by experience to vary between 3 and 20 per cent. of the sugar in the cane, which shows plainly enough how important it is to keep a watchful eye upon the losses, which are comparatively easy to obviate where they do not proceed from adherence to the "good old ways."

Chemical losses, proceeding from destruction of sugar in the juice, are all the more frequent in proportion to the thinness of the juice and the longer time it is kept at the usual tropical temperature of 80° to 100° F.

Destruction of sugar also ensues in consequence of unsuitable additions to the juice, such as "bloomer," cocoa-nut oil, phosphates, &c., and also from defective cleansing of the evaporating apparatus.

In the following formula, an amplification of the formula A already given, I have stated the calculation of minimum and maximum loss with double crushing and diffusion.

	a With Double Crushing Maximum.		*b* With Double Crushing Minimum.		*c* With Diffusion Maximum.		*d* With Diffusion Minimum.	
Sugar in the cane....	13·00	100·00	13·00	100·00	13·00	100·00	13·00	100·00
,, ,, juice	8·39	64·54	10·38	79·86	11·27	86·69	12·72	98·06
,, ,, cush-cush	0·90	6·92	0·61	4·68	—	—	—	—
,, ,, scum	0·36	2·77	0·26	2·00	—	—	—	—
,, ,, megass	4·61	35·46	2·62	20·14	1·42	10·92	0·25	1·92
,, ,, waste-water	—	—	—	—	0·31	2·39	—	—
,, in unascertainable losses	0·40	3·08	0·39	3·00	2·03	15·62	0·32	2·46
,, obtained in the masse-cuite	6·73	57·77	9·12	70·18	9·24	71·07	12·43	95·62
,, total loss	6·27	48·23	3·88	29·82	3·76	28·93	0·57	4·38
,, in ascertainable losses	5·87	45·15	3·49	26·82	1·73	13·31	0·25	1·92
Percentage of juice in the cane	88		88		88		88	
,, ,, obtained from the cane	56·8		70·2		76·3		86·0	
,, on juice in the cane	64·5		79·8		86·7		97·8	
,, of sugar in the megass	10·6		8·8		1·42		0·25	
,, of megass obtained from the cane	43·2		29·8		100·00		100·00	
,, of cush-cush from the cane	7·08		5·0		—		—	
,, of sugar in the cush-cush	12·7		12·2		—		—	
,, of scum in the cane	3·0		2·6		—		—	
,, of sugar in the scum	12·0		10·0		—		—	
,, of dilution of the juice	—		—		36		12	

The figures under *a*, *b*, *c*, *d* indicate as follows:—

a. Both mills are in a very bad condition, for they only give 56·8 per cent. and 6·45 per cent. of juice. Along with the cush cush caught by the sieves (7·08 per cent. of the cane) there was a loss in sugar of 6·92, which can be reduced to a minimum by extracting the juice in the cush-cush by a hydraulic press. With a weekly consumption of 2,000 tons of cane there were 17·78 tons of sugar lost, equivalent to a sum of at least $1,000. The bad condition of the mills caused a loss in sugar of about 40 tons, equal to about $2,000. The unascertainable losses, 3·08 per cent., which include not only loss of juice but also all errors in weighing, are within the normal limits.

b. In this case also a hydraulic press for the cush-cush (5 per cent. of the cane) should effect a weekly saving of $500.

c. The saccharine content of the diffused chips (1·42 per cent.) and that of the waste-water (0·31) indicates defective (too large) chips; greater attention must be paid to the sharpening of the cutting-knives; it is advisable to change them every six or twelve hours, replacing them by sharp, well-hardened blades. The outlet of juice is probably too small, and at the same time the calorisators have not been kept at a proper temperature. The very high unascertainable losses, 2·03 = 15·62, show that the battery must be suffering numerous and continued losses of juice from want of tightness in the valves and covers. They indicate a weekly loss of about 40 tons of sugar, equal to at least $2,000.

d. Shows the results of a well managed diffusion battery, and of an intelligent, careful, and accurate working of the factory.

When the masse-cuite leaves the vacuum-pan, it is best put into boxes holding from 3 to 5 cwt., so as to cool as quickly as possible; after 10 to 16 hours it is conducted through the pug mill to the centrifugals. In order to facilitate the work of the latter, molasses, which may be slightly heated, are added. Under any circumstances these molasses must be of such concentration, that at the temperature employed it forms a saturated solution, for only in such cases are we sure that none of the sugar crystals existing in the masse-cuite will be dissolved.

First Sugar obtained from the Masse-cuite.

The yield in first sugar obtained from 100 parts of masse-cuite depends on the amount of water contained in the latter, and on its

quotient of purity. The water should not amount to more than 5 to 6 per cent. The quotient of purity, *i.e.*, the figure indicating how much sugar there is in 100 parts of absolutely dry masse-cuite, is subject to variation during the entire duration of the manufacture, from the moment when the cane begins to be dealt with, that is, as soon as it lies cut on the fields. If the quotient of the masse-cuite is the same as that of the original juice of the cane, this is a proof that during the process of manufacture the quality of the juice has not changed.

If the quotient of the masse-cuite turns out to be lower than in the original juice, then sugar has been chemically destroyed during the process, and consequently a proportionately lower yield in first sugar must be looked for. The yield in first sugar from the masse-cuite, when the water contained is the same, is in proportion to the quotient; for instance, if 4 masse-cuites, with water = 5, have quotients as follows:—

Quotient.	Polarisation.			Plus in first sugar.
75	71·2	then the yield will be	56·25 =	100·0
80	76·0	,, ,, ,,	60·00 =	106·6
85	80·7	,, ,, ,,	63·75 =	113·3
90	85·5	,, ,, ,,	67·50 =	120·0

We obtain, therefore, with an equal saccharine-content of the original juice but with different quotients, 20 per cent. more or less of first sugar. The enormous importance of the quotients is made clearly evident by these figures. Every sugar manufacturer may easily convince himself of this fact by taking the trouble to have the cane and the masse-cuite accurately and regularly weighed, as in the course of manufacture variations of 75 to 90 in the quotient of the original juice constantly occur.

At the same time it becomes clearly evident how important it is to artificially produce, by proper means, an improvement of the quotient of the juice during the process of manufacture. In the beet sugar industry the knowledge of this fact has long ago been practically utilised, and during manufacture the original juice, whatever quotient it may have had, is brought up to a purity of 90 to 95, and 68 to 73 parts of first sugar are actually obtained from 100 parts of the masse-cuite.

The chemical supervision of the centrifugal operations consists in this, that in the laboratory the masse-cuite is not merely polarised, but that the quantity of water is ascertained and the quotient of purity calculated.

The water contained shows whether the sugar boiler has been doing his duty or not, *i.e.*, whether the masse-cuite has been properly boiled down.

The quotient shows whether it was possible to attain a water-content of 5 per cent., and also gives an accurate indication of the quantity of first sugar that may be expected from 100 parts of the masse-cuite; it enables us to judge whether the molasses used in the mashing was too thin, or whether the workmen had even employed water.

The yield in first sugar further depends also on the size of the grains formed, but this is closely connected with the quotient, for from a syrup with a low quotient no large grain sugar can be boiled.

The knowledge of the quotient of the juice further shows whether the sugar boiler understands his business, and whether he can be expected to produce the desired quality of grain or not. The operation and art of boiling are in some cases overvalued, and in others undervalued, not only by the superintendent of the sugar boiler, but often by the individual himself. The art of boiling consists in getting a given grain from a certain fixed quality of syrup; a masse-cuite should have a regular even grain and be firmly boiled down.

The molasses thrown off from the masse-cuite in centrifugaling represents, when the work is properly done, a so-called mother liquor, that is, a solution of certain substances in water, which, without further treatment, is incapable of separating any substance, including sugar, in a crystallised form. The composition of such molasses is usually as follows:—

Water	23·00		
Sugar	38·00	Quotient,	49·3
Glucose	13·00	do.	16·8
Salts	7·00		
Organic substances	19·00		
	100·00		

When such molasses are boiled down to about 42° Baume the result is a second sugar, polarising about 90, forming about 1·2 per cent. of

the weight of cane, or 21 per cent. of the weight of the second masse-cuite (*i.e.*, 18 to 20 lbs. per cubic foot); any larger yield in second sugar is obtained at the expense of the first sugar.

Finally there results a residuum molasses, about 4 per cent. of the weight of the cane, the composition being about as follows:—

Water	20·00
Sugar	30·00
Glucose	25·00
Salts	11·00
Organic substance	14·00
	100·00

According to formula A, a complete supervision of the working would then give as follows, for *a*, *b*, *c*, and *d*:—

	a. Double Crushing Minimum.		*b.* Double Crushing Maximum.		*c.* Diffusion Minimum.		*d.* Diffusion Maximum.	
Sugar in the:—								
Cane	13·00	100·00	13·00	100·00	13·00	100·00	13·00	100·00
Cush-cush	0·90	6·92	0·61	4·68	....	....	....	....
Scum	0·36	2·77	0·26	2·00	....	....	....	....
Megass	4·61	35·46	2·62	20·14	1·42	10·92	0·25	1·92
Waste water of diffusion	....	....	....	....	0·31	2·39	....	....
Unascertainable losses	0·40	3·08	0·39	3·00	2·03	15·62	0·32	2·46
Masse-cuite	6·73	51·77	9·12	70·18	9·24	71·07	12·43	95·62
First sugar	5·11	39·31	6·81	52·38	9·56	50·47	9·29	71·48
Second sugar	0·82	6·27	1·11	8·53	1·46	11·23	1·73	13·35
Molasses	0·64	4·92	1·13	8·69	0·95	7·30	1·38	10·66
Loss from masse-cuite to molasses	0·16	1·27	0·07	0·58	0·27	2·07	0·02	0·17

Obtained in the Factory.	Polarisation.	Percentage on Cane.	Percentage on Masse-cuite.	Polarisation.	Percentage on Cane.	Percentage on Masse-cuite.	Polarisation.	Percentage on Cane.	Percentage on Masse-cuite.	Polarisation.	Percentage on Cane.	Percentage on Masse-cuite.
Masse-cuite..	75·0	8·97	..	77·0	11·84	..	77·0	12·00	..	77·0	16·14	..
1st Sugar....	96·0	5·32	..	96·0	7·10	59·6	96·0	6·84	57·0	96·0	9·68	59·9
2nd Sugar ..	88·0	0·95	59·3	88·0	1·26	..	88·0	1·65	..	90·0	1·92	..
Molasses	32·0	2·00	..	32·0	3·53	..	31·0	3·06	..	30·3	4·4	..

In order to keep such figures accurate, reliable, and practically available for forming a judgment of the work done in the factory, both the results obtained in the laboratory and the factory must be ascertained without any mere estimating. The quantity of masse-cuite, first and second sugars, and molasses, also the quantity of cane from which the various products are obtained, must be ascertained by weighing.

The factory must be provided with a laboratory supplied with all the requisite apparatus and chemicals.

Such a calculation of losses as is represented in the preceding table affords a reliable idea of the working as regards defective or good arrangements of the factory, and the dependability and knowledge of their business possessed by the *personnel* of the establishment.

Along with the introduction of the diffusion process increased attention must undoubtedly be paid to the evaporating appliances and the production of steam as regards the arrangements for stoking. If these apparatus are technically perfect it is possible, especially if no mechanical losses of steam take place, to dispense entirely with the exhausted chips as fuel, as the following considerations will show.

The relative position of a factory with double crushing, where the juice is evaporated without coal, to a diffusion plant dispensing with the exhausted chips and burning only coal, is as follows:—

2,000 tons of cane give 401,020 gals. of
diffusion juice with a spec. gr. of 1.067, or.. 1,910·2 tons juice
2,000 tons of cane give .... 322·8 masse-cuite

Hence there will be 1,587·4 tons water

to be evaporated. For this are required—

264·6 tons of coal, costing ....$2,116·8
2,000 tons of cane give 51·6 tons of first sugar
more than double crushing, that is ....$3,612·0

There is, therefore, an increased gain of \$3,612, from which is to be deducted the \$2,116·8, leaving \$1,495·2.

The practice of weighing the cane before putting it into work is only slowly coming into operation, as local difficulties often stand in the way of the introduction of this desirable system.

In order to give an idea of the quantity of cane which is worked up under the diffusion system, I have drawn up the following formulæ, the authorship of which I desire to be recognised as claiming:—

$$x = \frac{100 \cdot s^1}{s}$$

$$s^1 = \frac{10 \cdot G \cdot w}{2240}$$

$$s = \frac{(Sc - Sa) \cdot p\,(100 + d)}{Sc \cdot 100}$$

x = tons of cane per diffusor.

S^1 = tons of juice extracted per diffusor.

s = tons of diffusion juice per 100 tons of cane.

G = number of gallons of diffusion juice extracted per diffusor at the average temperature of the chamber.

w = specific gravity of diffusion juice at the average temperature of the chamber.

Sc = percentage of sugar in the cane.

Sa = percentage of sugar in the exhausted chips plus the waste-water, expressed in percentage of cane.

d = percentage of dilution of the diffusion juice in relation to the original cane juice.

p = percentage of juice in the cane.

RESULTS OBTAINED ON EVAN HALL, BELLE ALLIANCE AND NEW HOPE PLANTATIONS.

CROP OF 1890.

(Continued from page 598.)

Lower Products.

After deducting the sucrose accounted for in the commercial sugars, calculating the glucose to the sucrose ratio which the final molasses should have, if no inversion had taken place during the handling of the lower products, and comparing same with the actual ratio found

by analysis, the inversion per cent. of the sucrose in the mill juice is found to have been :—

	Per cent.
On Evan Hall	2·22
On Belle Alliance	3·45
On New Hope	0·68

Compared with 1889 results, New Hope's work shows a marked improvement, since, where only 0·68 per cent. inversion can be detected, a 1·51 per cent. inversion was found in 1889. This is a decrease of nearly 55·00 per cent. At Evan Hall and Belle Alliance there was no improvement in this respect, on the contrary, the loss by this cause is found to be respectively about $2\frac{1}{3}$ and $1\frac{1}{3}$ times as great as in 1889.

Compared together, the above figures show that, during the handling of the lower products, Evan Hall inverted $3\frac{1}{2}$ times and Belle Alliance 5 times as much sucrose as was inverted at New Hope. In the Evan Hall special report it was suggested that this increase might result from the greater length of time that (owing to the poverty of the materials) the lower products had to remain in the hot-room.

The fact that, both at Evan Hall and Belle Alliance, the juices worked were among the poorest ever handled, and that New Hope's juices were more nearly up to an average good juice, seems to give weight to the supposed cause of the inversion just noted.

TOTAL LOSSES BY INVERSION.

Summing up the inversion noted at the different stages of the process, we have :—

	Per cent.
On Evan Hall	2·91
On Belle Alliance	3·63
On New Hope	0·76

Compared with the same data for 1889, this loss at Evan Hall is found to be about $32\frac{1}{3}$ times as large, at Belle Alliance $2\frac{1}{6}$ times, while at New Hope an 85·95 per cent. reduction is noted.

Compared together, Evan Hall's total inversion is found to be 19·56 per cent. less than Belle Alliance's, and New Hope's 73·88 per cent. less than Evan Hall's, and 79·06 per cent. less than Belle Alliance's.

(To be continued.)

NOTICES OF BOOKS.

1. Over de met roodkleuring gepaard gaande Verrotting der Stekken van het Suikerriet.* 2. Proefnemingen ter Bestridding der "Sereh." 3. De Bestridding der onder den naam "Sereh" saamgevatte Ziekteverschijnselingen van het Suikerriet.* All by Dr. Franz Benecke, of the Proefstation "Midden-Java"; Samárang, G. C. T. van Doorp & Co., 1891.
4. Onderzoek van eene Melasse.* By Dr. H. Winter; same date and publishers.

During the current year we have received successively the above publications, all forming a continuation of the series termed "Mededeelingen (Communications) van het Proefstation 'Midden-Java' te Samárang," We have also received the Fifth Annual Report of the Managing Committee of the "Midden-Java" Experimental Station for the year 1890-91. The paper by Dr. H. Winter has already appeared in full in our columns (see October number, pp. 517 to 522).

Dealing first with the Report of the Committee of the "Midden-Java" Station, of which Dr. Franz Benecke was chosen as director on the death of Dr. Soltwedel, we note the fact of Dr. Winter, the head of the Chemical Department, having decided to return to Europe, and Dr. Benecke having been prevented, by a mass of new work, by the necessity of altering his original plans, and by illness during three months, from pursuing the microscopical and bacteriological investigations respecting the "Sereh" disease which he had hoped to perform, and which are now left in other hands. A considerable number of experiments have been made with various disinfectants, the results of which will be published later. The editing of the work of Dr. Soltwedel, "Vormen en Kleuren van Saccharum Officinarum L., en van daarmede verwante species,"† was committed to Dr. Benecke by the Committee, and, as the plates are already being printed in Europe, he hopes to have it published this year. Dr. Benecke mentions, with special pleasure, the assistance which is being afforded and offered by scientific men in Europe, of whom he names Dr. M. Möbius, of Heidelberg, and Professor Hackel, of St. Pölten (Austria), which he

* 1. On the decay of sugar cane plants, accompanied by red coloration. 2. "Experiments for combatting the "Sereh." 3. "Means of dealing with the phenomena of disease comprised under the name "Sereh." 4. "Analysis of molasses,"

† Forms and Colours of Saccharum Off. L. (sugar cane), and of species allied thereto.

hails as an omen of progress in the work they are endeavouring to carry on in Java. The remaining portion of this notice will give an idea of the character of this work, and we proceed to consider the last and most interesting of the series, which deals with the means of combatting the various diseased phenomena comprised under the name of "Sereh." We are a little disappointed in finding that the question of the causes of these forms of disease, which have proved so fatal in some districts of Java, is as yet unsettled. We have ourselves for some time held the opinion that the main cause which has led to the development of the various symptoms of disease and decay, known as "Sereh," lay in the exhaustion of the soil and the omitting to return to it, in one form or other, some of its most valuable constituents. If we are not mistaken, some of the symptoms which are considered characteristic of "Sereh" have for many years been more or less in existence in the West Indian and Australian cane-fields, and have been kept in subjection by rational methods of manuring; indeed, we do not think too much stress can be laid on the enormous advantages to be gained from the liberal supply of what is really needed for the continuous healthy growth of a plant that takes so much out of the soil as the very luxuriant sugar cane. The pamphlet now before us is divided into six chapters, and we propose to give a translation of the first and a part of the second as a useful introduction to a summary of the others. Dr. Benecke commences:—

"While from certain districts, where the *Sereh* formerly did enormous damage, the reports respecting the cane and sugar production are quite favourable, we are hearing just the contrary from other parts of Java. In some districts the *Sereh* is making progress, in others it is decreasing. In consequence, some are adopting very pessimistic views, others are again looking forward to the future with confidence. However, taking *all* the circumstances into consideration, we have reason enough to continue to feel seriously afraid of the *Sereh*, for it may again attack those districts where people think the greatest danger is already past.

Many means for combatting the *Sereh* have been proposed, perhaps about as many as the causes to which it has been attributed. Most of these are, on the very face of them, valueless; of not one of them can it up to now be said, with any certainty, that it has been fully efficacious. I am not about to enter here into any details respecting

all the various remedies proposed, nor yet to criticise them further, I shall do this, as far as seems necessary, in further publications which will shortly appear, amongst which will be found one treating of the value of disinfecting the seed-canes. I have been reproached with having too hastily formed a judgment beforehand as to the value of disinfectants; this I must deal with later, for it is evident that I cannot give a *resumé* of all the various results before I have obtained them, and, in the first place, all the plots on which experiments have been made have not yet been cut; I therefore ask gentlemen who are interested in this question to have patience a little longer, and then *nous verrons*.

The planters of Java, whose cane-fields have been attacked by the *Sereh*, have principally to thank our Experimental Stations, and notably the late Dr. Soltwedel, for having thus far been able to keep their heads above water, for Soltwedel was the first to energetically support the importation of seed-cane from uninfected districts, and this has, as a matter of fact, been up to now the very best remedy that has been used in the battle against the *Sereh*.

But must we continually go on importing?

I believe that we are at present in any case warranted in fearing that this importation will cease some fine and possible not very distant day. What then shall be done? Many see a remedy in the establishment of fields for growing seed-cane in the high lands. We will just suppose that this remedy would produce lasting good results. But if this were the only remedy, could all our plantations take advantage of it? We certainly have enough of mountainous districts in Java, but are there also sufficient appropriate localities, are there water, or labour, or practicable roads everywhere? As I am not thoroughly posted up on geographical, social, and communal questions, I have no perfectly clear insight into the position of things, but I believe I shall not be very far from the mark in assuming that the establishment of seed-cane plantations in the mountains is hardly possible for even a portion of our planters. Above everything, the expense plays a prominent part in such matters. The prospects which are afforded us by the world's market as regards the prices of sugar, are unfortunately not such as to allow us to cherish the hope that there is a probability of the outlay, which the establishment of mountain plantations would cause, being made good by higher prices.

These unfavourable prospects as regards prices of sugar require us to make ourselves, as quickly as possible, masters of the *Sereh*, otherwise our industry will get the worst in the competition with beet sugar. If that industry had an enemy in *one* quarter only, then we should have no need to take a dark view of things, for Java is and will remain an exceptionally fertile country, to an extent which cannot be said of many other countries. But considering we have the *Sereh* as an enemy at our backs, and the beet industry of Europe, and probably also of America to boot, in front of us, then, indeed, are the chances too unequal for us possibly to expect to triumph in the contest.

As far as our knowledge yet goes, the only hope of successfully combatting the *Sereh* lies in keeping to that material for seed-cane which is still good, or else in obtaining new material derived from other varieties of cane, and this appears to me to best attainable by a correct choice of seed-cane, a choice corresponding to the principles which I shall develop in the succeeding chapter.

The most careful selection of seed-cane. This demand is by no means new. Experienced planters have made it long ago, and it has been repeated with emphasis also by the men of science.

In the following short compendious sentences is sketched out in principle the method which I very emphatically desire to recommend as the best remedy for combatting the *Sereh* and also other diseases of the cane:—

1. Every cutting, that is destined for planting, must in future have come from a seed-cane field.

2. For laying out such a field the material must in future be taken *exclusively* from another previously laid-out seed-cane plantation.

3. Two kinds of such plantations must be laid out:—

a. Those, from which the plants eventually harvested, which are primarily designed for laying out new seed-cane fields. These I shall for shortness designate propagation seed-cane fields, because from them the selected planting material shall always be propagated afresh.

b. Those, the plants eventually harvested from which are exclusively designed for planting out for the crop. These I will for shortness designate factory seed-cane fields.

4. Neither of these two classes of cane-plant fields must be more than *six months old* when cut.

5. For the propagation seed-cane fields only irreproachable middle joints (1 to 4) must be used.

6. For both these kinds of fields, but above all the propagation fields, soils must be selected which, both as regards irrigation, drainage, and quality, are the best on the estate, and such soils must be thoroughly well worked and properly manured."

Two tables are added, illustrating the way in which the proposed system will operate, and to their explanation the third chapter is devoted.

The fourth chapter justifies the principles laid down in the second, and special stress is laid on the novelty and value of the idea of the two kinds of cane-plant fields. The exclusive use of the middle joints for planting is defended from the results obtained by the experiments of Dr. Kramers, at the "Oost-Java" Station. Dr. Benecke particularly states that he has always preached thorough working of the soil, assiduous manuring, and careful irrigation, as the best means of fighting the *Sereh*, and he means to stick to his text. In this respect, at least, we are thoroughly at one with him, and are much more disposed to look for immediate and permanent success to such practical means as he now proposes than to any laborious and long-continued bacteriological and chemical investigations. The remaining chapters contain hints as to consistent following out of the ideas propounded, and an appeal to planters to do this, if even, at the outset, only by way of experiment, but not to be dallying and waiting. Dr. Benecke does not regard as radical the remedy which he proposes, but only believes it to be the best practical one.

We may mention that to meet, to some extent, the regrets which have been expressed in many quarters that these "Communications" are published only in Dutch, a language but little known, a short German abstract of the contents will now be added at the end of each pamphlet.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; 63, Long Row, Nottingham; and 323, High Holborn, London.

ENGLISH.—Applications.

17776. W. J. Mirrlees, Glasgow. (Communicated by J. C. Riley, United States.) *Improvements in sugar mills.* (Complete specification.) 17th October, 1891.

18292. FRITZ SCHEIBLER, London. *Improvements in apparatus for liquoring sugar.* 24th October, 1891.

18627. J. C. RICHARDSON, London. *Improvements relating to electrodes to be used in the electrolysis of solutions.* 29th October, 1891.

19257. E. W. CATFORD, Bristol. *An improvement relating to the process of coating and colouring sugar crystals.* 7th November, 1891.

19486. D. B. MORISON, London. *Improvements in and connected with apparatus for heating or evaporating liquids.* 10th November, 1891.

19570. G. F. REDFERN, London. (Communicated by William Price Abell, British Guiana.) *Improvements relating to centrifugal machines.* 11th November, 1891.

19607. H. A. A. DOMBRAIN, 27, Kirkgate, Bradford, Yorks. *Improvements in apparatus for squeezing liquids from pulverulent and granular substances.* 12th November, 1891.

19608. D. SEATHEM, Glasshoughton Collieries, Glasshoughton, near Pontefract. *A method of securing rails for locomotives, tramcars, colliery corves, sugar-cane trams, and any other vehicle.* 12th November, 1891.

19694. H. PAPE and W. HENNEBERG, London. *Improvements in or relating to centrifugal separators for granular substances.* 13th November, 1891.

19729. H. ANDREE, Sheffield. *Improvements in centrifugal machines for syrups and other liquids.* 14th November, 1891.

19762. R. and T. MORTON, Glasgow. *Improvements in and connected with pans for boiling or heating sugar or compounds thereof or similar substances.* 14th November, 1891.

19774. JAMES Y. JOHNSON, London. (Communicated by Carl Pieper, Germany). *Improvements in the manufacture of grape sugar and grape sugar syrup.* 13th November, 1891.

ABRIDGMENTS.

12808. RAMON F. CORDERO, Section of Sachira, Los Andes, Venezuela, farmer. *Improvements in apparatus for washing sugar.* 5th September, 1891. This is an apparatus for the economic extraction of the molasses from raw sugar by means of alcohol, and provides means for the complete recovery of the solvent. A conical extraction chamber is employed, and the boilers, condensers, and connections are shown in detail.

17557. A. WOHL AND AUR, of 104, Chaussee Street, Berlin, doctors of philosophy. *Improvements in the production of invert sugar.* 1st November, 1890. This is a patent for improvements on patent 16540 (1889), and comprises the removal of the volatile organic acids by treating a heated and concentrated acid solution of sugar by means of air or steam, or both, supplied through an injector or otherwise.

AMERICAN.

ABRIDGMENTS.

459496. ALFREDO LEBLANC, of Havana, Cuba. *Method of extracting cane juice and apparatus therefor.* 15th September, 1891. In the example of machine shown in the drawings, five rolls are employed between which the cane is crushed, being treated at various stages with steam and with water. The inventor asserts that a larger percentage of juice can be obtained by this method of working.

459654. REGINALD M. SANDYS, of New Orleans, Louisiana. 15th September, 1891. *Diffusion apparatus.* The cane is first passed through a three-roller mill, and thence into a diffusion trough, through which it is conveyed by means of an endless rake mounted on sprocket wheels to a two-roll mill. During its passage to the trough it is treated with fresh water and lime water, or other defecating agent, supplied by separate pipes having valves governed by a float. Steam may be supplied at suitable points in the trough.

21101. FREDERICK W. THOMPSON, of Southbank, Stapenhill Road, Burton-on-Trent, analytical chemist. *An improvement in the manufacture of invert sugars.* 27th December, 1890. This comprises improvements on a former patent, viz., 8686, 1884, and has for its object to produce a purified product which is obtained by clarifying a crude solution of glucose by adding precipitated sulphate of lime. After filtering the solution can be purified by charcoal and concentrated in the usual way.

16326. THOMAS SLAITER, of 26, Eastbank Street, Stamford Hill, Stoke Newington. *Improvements in multiple evaporating apparatus.* 14th October, 1890. Improvements on former patents Nos. 10493 (1888) and 34 (1889). A horizontal cylindrical casing having hollow ends is traversed from end to end by a series of troughs, and internal openings are made in said ends through which the liquor under treatment is caused to flow along said troughs, and is heated in its travel by steam pipes lying therein, and passing through the ends of the casing, where they are connected by elbow bends.

GERMAN.

ABRIDGEMENTS.

56889. HARALD E. HANSEN, Copenhagen. *Evaporating apparatus.* 26th August, 1890. A funnel provided with a double lining, heated from the interior by a steam pipe, and revolving on a spindle, is set in movement. The liquid to be evaporated passes through two pipes on to the inner and outer surface of the funnel, and by the revolution of the same assumes a spiral form, so that both surfaces are gradually covered with a fine deposit. When evaporation ceases, this residue is scraped off from the surfaces of the funnel and removed through an aperture provided in the apparatus.

56940. WILLIAM P. ABELL, L'Union, Essequebo, British Guiana and GEORGE FLETCHER, Masson Works, Litchurch, Derby, England. *Continuous acting centrifugal machine for manufacturing sugar masse cuite and the like.* 23rd August, 1890. Three perforated rotating cylinders or many sided vessels are fixed in this centrifugal machine. The masse cuite to be centrifugalled is conducted without interruption to the funnel surrounding the principal axis, from where it is conveyed through a pipe into the separate divisions of the cylinder, which rotate with the principal axis and at the same time perform a slower movement round their own axis. The liquid constituents of the masse cuite are, in consequence of the centrifugal power, centrifugalled off through the openings of the cylinder against the jacket, while the separated sugar crystals remain behind in the compartments of the cylinder. If, now, by the rotation of the cylinder round its axis a compartment comes into juxtaposition with the connecting line of its own axis and the principal axis, the separated crystals, in consequence of the centrifugal power exerted, are centrifugalled against the funnel-shaped insertion piece. This funnel is continued underneath through an opening, and by this means the separated sugar crystals are conveyed to a receiving funnel, from which they fall into a receiver placed underneath the centrifugal machine. The machine empties itself automatically.

IMPORTS AND EXPORTS (UNITED KINGDOM) OF RAW AND REFINED SUGARS.

JANUARY 1ST TO OCTOBER 30TH.

Board of Trade Returns.

IMPORTS.

Raw Sugars.	Quantities.		Value.	
	1890.	1891.	1890.	1891.
	Cwts.	Cwts.	£	£
Germany	5,388,948	4,981,969	3,266,037	3,116,264
Holland	366,986	352,140	212,725	217,627
Belgium	883,866	636,350	517,312	385,215
France	1,026,160	1,176,925	643,558	782,372
British West Indies & Guiana	1,141,318	857,981	857,836	676,636
British East Indies	626,684	939,033	323,126	490,305
China and Hong Kong	....	....	....	....
Mauritius	214,803	203,698	135,273	124,887
Spanish West India Islands	42,130	19,935	31,597	15,699
Brazil	333,849	420,304	202,453	254,321
Java	1,023,318	1,932,198	727,686	1,317,238
Philippine Islands	242,433	823,902	128,335	436,764
Peru	544,922	330,192	369,726	230,779
Other Countries	333,232	482,861	236,116	326,148
Total of Raw Sugars	12,168,649	13,157,488	7,651,780	8,374,255
Molasses	538,093	431,716	174,435	131,285
Total Sugar and Molasses	....	....	14,308,251	15,757,966
Refined Sugars.				
Germany	3,851,834	5,008,964	3,116,115	4,075,406
Holland	1,519,018	1,407,673	1,263,845	1,191,304
Belgium	132,547	163,792	118,387	142,852
France	2,168,186	1,680,874	1,762,938	1,380,900
United States	259,656	532,114	217,088	447,061
Other Countries	4,309	18,671	3,663	14,903
Total of Refined	7,935,550	8,812,088	6,482,036	7,252,426

EXPORTS.—Refined Sugars.

	Cwts.	Cwts.	£	£
Sweden and Norway	55,141	75,221	41,009	57,217
Denmark	111,504	123,206	68,722	78,259
Holland	75,662	71,268	53,766	50,860
Belgium	24,597	21,658	17,108	15,140
France	4,772	552	3,114	437
Portugal, Azores, & Madeira	67,900	63,057	45,621	44,354
Italy	65,615	36,769	44,699	26,351
Other Countries	185,082	231,076	142,012	172,611
Total of Exports	590,273	622,807	416,051	445,229

IMPORTS OF FOREIGN REFINED SUGAR.

The following figures give the imports of foreign refined sugar for the month of October, 1891, compared with the corresponding month of the two preceding years, and the average monthly imports for the year compared with those of 1888, 1889, and 1890, distinguishing the quantities of "Lumps and Loaves" from "other sorts," and giving the separate imports from each country:—

Countries from which Sugar has been imported.	"Lumps and Loaves." Including Cut Loaf and Cubes.							"Other Sorts." Including Crushed Loaf, Granulated, Crystallized, &c.							Total.						
	Monthly Average.				Oct.	Oct.	Oct.	Monthly Average.				Oct.	Oct.	Oct.	Monthly Average.				Oct.	Oct.	Oct.
	1888	1889	1890	1891	1889	1890	1891	1888	1889	1890	1891	1889	1890	1891	1888	1889	1890	1891	1889	1890	1891
	Tons.	Tons.	Tons.	Tons.	Tons	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France	1686	2373	2883	2005	3027	1354	1555	4855	8596	7956	6399	16752	12174	12932	6541	10969	10839	8404	19779	13528	14487
Holland	3267	2294	2972	3236	2527	3315	3820	2675	3354	4622	3763	4935	5011	3499	5942	5648	7594	6999	7462	7326	7319
Germany & Austria	1510	2573	2449	2923	2348	948	1196	11729	13844	16810	22221	11066	10759	15368	13239	16417	19259	25144	13414	11707	16564
Belgium	622	827	371	374	716	444	477	227	225	291	445	223	767	2000	849	1052	662	819	939	1211	2477
United States	8	..	113	102	..	..	..	157	42	1185	2558	6	717	10	165	42	1298	2660	6	717	10
Russia	..	23	..	..	..	..	..	1959	2015	..	84	50	..	..	1959	2038	..	84	50	..	..
Other Countries	1	239	..	..	..	..	..	2	355	21	10	110	4	35	3	594	21	10	110	4	35
Total	7094	8329	8788	8640	8618	6061	7048	21604	28431	30885	35480	33142	29432	33844	23698	36760	39673	44120	41760	34493	40892

SUGAR STATISTICS—GREAT BRITAIN.

FOR THE FOUR PRINCIPAL PORTS.

To NOVEMBER 21ST, 1891 AND 1890.

IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

	STOCKS.		DELIVERIES.		IMPORTS.	
	1891.	1890.	1891.	1890.	1891.	1890.
London	36	.. 23	$268\frac{1}{2}$	.. $245\frac{1}{2}$	279	.. $220\frac{1}{2}$
Liverpool ..	32	.. 49	$268\frac{1}{2}$	.. $246\frac{1}{2}$	247	.. $208\frac{1}{2}$
Clyde	17	.. 29	171	.. 188	$160\frac{1}{2}$	.. 188
Bristol	$2\frac{1}{2}$	.. $1\frac{1}{2}$	57	.. 56	68	.. 56
Total ..	$87\frac{1}{2}$	$102\frac{1}{2}$	765	736	$744\frac{1}{2}$	673

The above figures do not represent accurately, or to the full extent, the position and movements of sugar in the United Kingdom, as Hull, Leith, &c., are not included, there being no published returns for these ports.

SUGAR STATISTICS—UNITED STATES.

From Willett & Gray's Report.

FOR THE FOUR PRINCIPAL PORTS. IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND. FOR OCTOBER, 1891 AND 1890.

	STOCKS. November 1st.		DELIVERIES. In October.		IMPORTS. In October.	
	1891.	1890.	1891.	1890.	1891.	1890.
New York	20	.. 13	66	.. 42	42	.. 36
Boston	—	.. $\frac{1}{2}$	$15\frac{1}{2}$	.. 7	$11\frac{1}{2}$	.. $5\frac{1}{2}$
Philadelphia....	$\frac{1}{2}$	.. —	50	.. 20	49	.. 20
Baltimore	—	.. —	4	.. —	4	.. —
Total......	$20\frac{1}{2}$	$13\frac{1}{2}$	$135\frac{1}{2}$	69	$106\frac{1}{2}$	$61\frac{1}{2}$
Total for the year			1334	1038	1327	1040

NEW YORK PRICES FOR SUGAR.

From Willett & Gray's Report, November, 1891.

FAIR REFINING.	96o/o CENTFS.	GRANULATED.	STAND. A.	STOCK IN FOUR PORTS.
Nov. 12, 1891.—3 1-16c.*	3 7-16c.*	4 3-16c.†	$4\frac{1}{8}$c.†	Jan. 1, 1891— 27,756 tons.
Nov. 13, 1890.—$4\frac{7}{8}$c.	$5\frac{1}{2}$c.	$6\frac{1}{8}$c.	$5\frac{3}{4}$c.	Jan. 1, 1890— 11,169 tons.
Nov. 14, 1889.—$4\frac{1}{4}$c.	$5\frac{3}{8}$c.	$6\frac{7}{8}$ 15-16c.	$6\frac{3}{8}$c.	Jan. 1, 1889— 32,254 tons.
Nov. 15, 1888.—5 1-16c.	$6\frac{1}{4}$c.	$7\frac{1}{4}$c.	$6\frac{7}{8}$c.	Jan. 1, 1888— 47,798 tons.
Nov. 17, 1887.—5 3-16c.	6c.	$6\frac{5}{8}$ 11-16c.	6 5-16c.	Jan. 1, 1887—102,279 tons.
Nov. 18, 1886.—$4\frac{5}{8}$c.	$5\frac{1}{8}$c.	5 11-16c.	$5\frac{1}{4}$c.	Jan. 1, 1886— 57,328 tons.
Nov. 19, 1885.—$5\frac{3}{8}$c.	6c.	$6\frac{1}{2}$c.	6 3-16c.	Jan. 1, 1885— 89,186 tons.
Nov. 13, 1884.—5c.	$5\frac{5}{8}$c.	$6\frac{1}{8}$c.	5 13-16c.	Jan. 1, 1884— 60,900 tons.
Nov. 15, 1883.—$6\frac{5}{8}$c.	7 9-16c.	$8\frac{1}{8}$c.	$7\frac{1}{2}$c.	Jan. 1, 1883— 50,297 tons.
Nov. 16, 1882.—$7\frac{5}{8}$c.	8c.	$8\frac{7}{8}$c.	$8\frac{1}{2}$c.	Jan. 1, 1882— 43,927 tons.

* Net Cash.

STOCKS OF SUGAR IN THE CHIEF MARKETS OF EUROPE ON THE 31ST OCTOBER, 1891, FOR THREE YEARS, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining 4 principal entrepôts.	TOTAL 1891.	TOTAL 1890.	TOTAL 1889.
79	177	110	115	4	16	501	464	599

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING 31ST OCTOBER, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining 4 principal entrepôts.	TOTAL 1890-91.	TOTAL 1889-90.	TOTAL 1888-89.
1407	536	507	305	53	380	3188	3093	2789

ESTIMATED CROP OF BEETROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE PRESENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1891-92. Tons.	1890-91. Tons.	1889-90. Tons.	1888-89. Tons.
German Empire	1,245,000	1,331,965	1,264,607	990,604
France	700,000	694,037	753,078	466,767
Austria-Hungary	850,000	778,473	787,989	523,242
Russia	515,000	525,000	456,711	526,387
Belgium	195,000	200,000	221,480	145,804
Holland	50,000	61,307	55,813	46,040
Other Countries	75,000	80,000	80,000	87,000
	3,630,000	3,670,782	3,619,678	2,785,844

The figures for Germany, France, and Russia have been reduced this month. By an error in copying, the figures for France and Austria were changed, one for the other, in our issue for November.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

During the first half of the month just closed prices for cane sugar were steadily but slowly advancing, the tendency during the last fortnight having been more marked, and cane refining kinds having been readily sold at higher quotations, grocery kinds not quite so well, though the advanced prices have been firmly maintained, and we have to report a general rise of about 9d. on coarser and 1s. on finer kinds.

As usual about this time, the state of the European beet crop has proved the determining factor, and the tolerable certainty that the amount of beet sugar produced this year would fall short of the first estimates gradually had its effect in raising the quotations, which now close from 1s. 4½d. to 1s. 6d. higher than at the end of last month. The anticipation, expressed in our September issue, that the 1891-92 beet production would be about the same as that of the current year, seems likely to be verified. We adhere to our October statement of opinion that an upward movement is likely to characterise the market during the next few months.

There was a brisk trade in refined sorts all through the month, and a reference to the prices quoted underneath will show that a marked advance has been established.

Present quotations for the standard qualities, as under, are:—

	Floating.		Last Month.
Porto Rico, fair to good Refining	13/3 to 14/6	against	12/9 to 14/-
Cuba Centrifugals, 97°/₀ polarization	15/9	,,	14/9
Cuba, fair to good Refining	13/6 to 14/-	,,	13/- to 13/6
Java, No. 14 to 15 D.S.	16/3 to 16/6	,,	15/3
British West India, fair brown	13/-	,,	12/3
Bahia, low to middling brown	11/3 to 12/3	,,	10/6 to 11/3
,, Nos. 8 and 9	12/9 to 13/3	,,	11/9 to 12/3
Pernams, regular to superior Americanos..	12/- to 13/9	,,	10/9 to 12/9
	Landed.		
Madras Cane Jaggery..	10/9	,,	10/-
Manila Cebu and Ilo Ilo	10/-	,,	9/3
Paris Loaves, f.o.b...	18/- to 18/3	,,	17/3
Russian Crystals, No. 3, c.i.f.	15/9 to 16/-	,,	15/-
Titlers	19/9	,,	18/9
Tate's Cubes..	22/-	,,	20/6
Beet, German and Austrian, 88%, f.o.b. ..	14/4½	,,	13/-